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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. APRIL 13, 1899. CHICAGO, ILL. NUMBER 15

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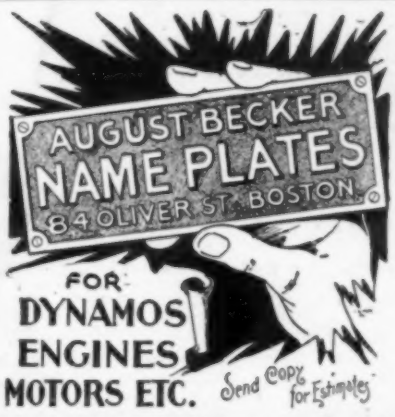

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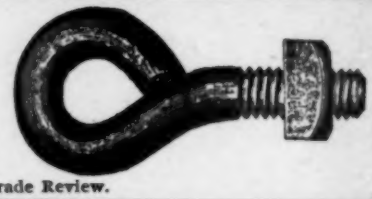

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. APRIL 13, 1899. CHICAGO, ILL. NUMBER 15

WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Quietness without weakness is the present condition of the iron market. Since the third week of March there has been no advance in pig iron, and with a few exceptions, prices in finished lines have been at a stand. Yet there is not the slightest sign of abatement of consumption, save only such foreign business as high prices may cut off. Stocks of pig iron continue to diminish, both of Bessemer, foundry and basic irons. Furnaces in the Mahoning and Shenango valleys shipped 35,000 tons more Bessemer iron than they produced in March. And in foundry iron the enormous consumption is a matter of common knowledge, indications being that it is still growing. In one Central Western district a canvass indicates that it was about 40 per cent more in the quarter ending with March, than in the first quarter of 1898; and the first quarter of 1899 showed a 10 per cent increase over the last quarter of 1898. Over against this is to be set the uncertain amount that will be added to the supply of iron by the various furnaces that are resuming or preparing to resume, less the productive capacity of furnaces that drop out from time to time for repairs. The indications still are that the second quarter and the beginning of the third are to show a tightness that may become a scarcity. Some of the furnaces that are to become active in the next three months have sold considerable iron, and there is a steady small-lot trade from the foundries; but at the moment there is a pronounced wait on business looking to the remoter future. For the good of the whole trade this might be prolonged for some weeks. Sellers seem to be in a position in which they will not lower prices, unless in the face of developments unexpected, and not now likely; and it is recognized that the situation is one in which no great increase in demand or interruption of supply would result in further advances. Meantime there is no disposition to advance prices, nor is there willingness to pay an advanced price on the present showing. It is simply a healthy, desirable lull. After pig iron, finished material is to be considered, for under the present regime of consolidations completed and consolidations pending, there is little or no market on intermediate material. Indeed, it would seem that billets, sheet bars and rods are now eliminated in large part, as market factors. Something still hinges on the outcome of the move for sheet mill amalgamation. The plans of the large concerns, as portions of them have developed, show signs of harmonious operation, indicating that for the near future, at least, there will be no disposition to contest for trade in certain lines or in certain districts. Stability of values is not threatened from this source, at least; and as long as there is plenty of business the question of its distribution will not be serious. It appears that the mills, with all their large outputs, are not gaining on the situation. With all the plate mill capacity now being added in the Pittsburg district, there is no indication that lower prices will be made for business in the second half. Sheets likewise are very firm, and the same situation appears in bars. The new business placed with the mills in the past week has not been large, but each week's specifications on contracts only emphasize the volume of consumption in all lines.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World*,
705 PUBLICATION BUILDING, April 12.

Prices in the iron and steel market show less change this week than usual. The general situation is one of maintained strength. The prospects are that present prices will in the main be well held through the season, and if anything at all serious should develop in the Lake Superior mining troubles, the effect on the iron trade would be very important, as even a slight disturbance to the ore supply would greatly magnify the present tension in the matter of deliveries of all crude materials.

The effect on the iron trade of the consolidations already formed, and those being formed, will be important. The leading interests are strengthening their position by a number of deals which will bring them into such close harmony as regards the raw material for their various purposes, that the tonnage passing through the open market will become more and more restricted. Already there is a perceptible effect on the market due to the pendency of certain deals which are being quietly negotiated.

There is still very little business being done for the third and fourth quarters of the year, and with the generally sold up condition of mills to July 1, the market has not been an active one. While there is general speculation as to what will be the prices at which the bulk of the tonnage for the latter half will change hands, the backwardness of buyer and seller need not be taken as an indication of anything more than a desire to do business strictly on the basis of the actual conditions, and the situation in this regard is not clear. Buyers in many cases have suffered from covering too far ahead, and producers have certainly suffered in this present movement from too much precipitancy; and in all cases the memory of sales and purchases which proved disadvantageous is stronger than of those which proved the reverse—an attribute of human nature which is leading the iron trade in the direction of a solid and conservative policy.

At a meeting held in Pittsburg last Friday the manufacturers of cold rolled steel shafting advanced the discount from 45 per cent off list to 40 per cent off, an advance of a trifle over 9 per cent on net prices. The free district was made to include Canada.

The manufacturers of coil chain, who have a gentlemen's agreement in regard to prices, last week made an advance of a quarter of a cent a pound.

PIG IRON.—The week has been without important developments. In Bessemer there has been practically nothing done, and the most interesting feature has been the active efforts of holders of the few remaining lots of outside iron to dispose of their holdings at prices under the recognized market. These are lots of only a few hundred tons, mainly storage iron, and do not find a ready market, as interest centers in the demands of the large consumers for the latter half of the year. The experience of these holders indicates that there is really no market for nearby deliveries of Bessemer, while the price of $14.50, valley, is established for the third and fourth quarters. No sales have been made beyond the 150,000 tons or so which were disposed of shortly after the price for the latter

half was agreed upon. In foundry and mill iron there are occasional odd sales, but no general movement. While bottom prices are as given below, there are now and then sales at considerably higher prices, the price being determined by the nearness of the delivery, the urgency of the buyer, and the suitability of the particular brand to his requirements. The furnacemen having realized less than they desired from the present advance, are in no mood to lessen their demands for deliveries in the third and fourth quarters, while the memory of declining markets and long contracts is still fresh in the minds of many foundrymen, so that conditions are quiet and will likely remain so for some time. We quote:

Bessemer, valley furnace	$14.50
Bessemer, Pittsburg	15.15 to 15.25
No. 1 Foundry	15.75 to 16.00
No. 2 Foundry	15.50 to 15.75
No. 3 Foundry	15.00 to 15.50
Gray Forge, valley furnace	14.00 to 14.50
Gray Forge, Pittsburg	14.25 to 14.50

STEEL.—Consumers no doubt could fill their requirements for the third and fourth quarters at about the present range f prices for steel, both Bessemer and open-hearth. b ut are not taking hold, while sellers are satisfied to let things take their course. There are occasional odd sales of Bessemer billets, for nearby deliveries, at former rates, and $25.50 about represents the market. In open-hearth billets the scarcity is still more pronounced than in Bessemer, and fancy prices, above $30, are occasionally realized for small lots.

FERRO-MANGANESE.—The price of ferro has been further advanced by the associated producers, and the minimum is now $75 for 80 per cent.

STRUCTURAL MATERIAL.—The demand for structural shapes is constantly increasing and a regular tonnage is being booked. Prices remain as formerly quoted: Beams and channels, 3 to 15 inches, 1.50c; 18 to 24 inches, 1.60c; tees, 1.55c; zees, 1.50c; and angles, 1.50c to 1.55c; universal mill plate, 2c.

RAILS AND TRACK MATERIAL.—There is nothing important in the rail market, the agreed price remaining $25 for light and heavy sections. In track material there is a steady and large demand, with prices unchanged as follows: Spikes, 1.80c to 1.90c; track bolts, 2.20c to 2.40c; splice bars, 1 50c to 1.70c; links and pins, 1.80c to 1.90c.

BARS.—The market for both steel and iron bars is strong, at former prices, steel bars being held at 1.60c to 1.70c, and iron bars at 1.55c to 1.60c.

PLATES.—The plate market is very firm, makers being about filled up for deliveries this side of July 1, while beyond that only occasional orders are being booked. Prices are a trifle firmer, and we quote: Tank plate, 2.10c; shell, 2.20c; flange, 2.20c; fire box, 2¾c to 3½c.

SHEETS.—There can scarcely be said to be a market in sheets, as mills are well filled with orders for all the sheets for which they can get material, and only occasionally can anything further be taken. The small volume of business being done is about on the basis of 2.75c for No. 28 common. A comparatively large business is being done in the heavy gauges, and at prices above the parity with the standard.

PIPES AND TUBES.—The consolidation negotiations are completed so far as the mills to be embraced are concerned, only one interest, the Tyler Tube & Pipe Co., of Washington, Pa., being omitted. The market is very firm, and without concerted action practically all the manufacturers have dropped one of the tens in the additional discounts named below. Casing has been advanced about 10 per cent, making the association list as follows: Merchant pipe, base discount 60 per cent and additional discounts five 10's for less than carloads and five 10's and 5 for carloads, with free delivery on the latter within the prescribed territory; lap weld casing, 52½ for screw and socket joint and 47½ for inserted joint, with 5 per cent additional on carload orders; boiler tubes, 1¼ to 1½-inch, 45 per cent; 1¾ to 2½-inch 55 for iron and 60 for steel; 2¾ to 6-inch, 60 for iron and 62½ for steel, all with an extra 5 per cent to dealers.

SPELTER.—The spelter market is firmer than at last report, and the Pittsburg market is quoted at 6.35c to 6.40c.

OLD MATERIAL.—There has been no change in prices of old material. Mills are pretty well supplied, and there is some pressure on the part of sellers. We quote: New melting stock, $14.50 to $14.75; old steel rails, long lengths, $12.50 to $13; cut, $13 to $13.50; old iron rails, $17 to $18; wrought iron scrap, $15 to $16, valley; cast borings, $8, net, Pittsburg; busheling scrap, $11 to $11.50, net; car wheels (nominal), $14 to $14.50, gross; cast scrap, $12, gross; charcoal scrap, $13, gross; wrought turnings, $8 to $8 50, net, Pittsburg.

COKE.—The coke market is without noteworthy feature, except that production keeps fully up to the strong pace recently set. Prices remain unchanged, strictly Connellsville furnace coke being held at $1.75 and crushed and foundry $2.15 to dealers and $2.30 to consumers.

IRON AND STEEL SKELP.—There is practically no market in skelp material, the mills having about all they can carry up to August, beyond which buyers are not anxious to take hold, although prices below present rates are quoted. For delivery within the next 60 days 1.75c would have to be paid for either iron or steel grooved skelp, while sheared is still scarcer than grooved.

CHICAGO.

OFFICE OF *The Iron Trade Review and Industrial World.*
1522 MONADNOCK BLOCK, April 12.

General conditions have changed very little in the week. The demand for most kinds of iron and steel is large, and sales have footed up as large a tonnage as the mills were willing to take. Prices are unchanged, and while many buyers are inclined to think they are at the top at present, and will be lower later, there are no indications that this is the case.

PIG IRON.—Sales of pig iron last week were limited to comparatively small lots, no large orders having been taken. There is considerable demand for iron for delivery in the last half of the year, and a few sales were made for this delivery. Buyers appear to have come to the conclusion that there is nothing to be lost and a possible gain by waiting until later in the year before placing their orders, but the furnaces are very firm in their views, and maintain that present prices will prevail for a considerable time to come. Quotations are made as follows:

Lake Sup. Charcoal	$17 00 @ $18 00	Southern Coke No. 3	$14 75 @ 15 00
Local Coke Fdy. No. 1	15 50 @ 15 75	Southern No. 1 Soft	15 50 @ 16 00
Local Coke Fdy. No. 2	15 00 @ 15 50	Southern No. 2 Soft	15 00 @ 15 50
Local Coke Fdy. No. 3	14 50 @ 14 75	Southern Silveries	15 50 @ 16 00
Local Scotch Fdy. No. 1	15 50 @ 15 75	Jackson Co. Silveries	17 00 @ 18 00
Local Scotch Fdy. No. 2	15 00 @ 15 50	Ohio Strong Softeners	15 50 @ 16 50
Local Scotch Fdy. No. 3	14 50 @ 14 75	Alabama Car Wheel	17 50 @ 18 00
Southern Coke No. 1	16 00 @ 16 25	Malleable Bessemer	15 50 @ 16 00
Southern Coke No. 2	15 25 @ 15 75	Coke Bessemer	15 50 @ 16 00

BARS.—The market is quiet, mills preferring to wait unti after the completion of the consolidation of iron manufacturers before taking any large business. There is a considerable tonnage which will be placed as soon as the mills are in position to accept orders, and some buyers are very anxious to know the prices they will have to pay. There is no further news regarding the consolidation, except that a meeting is being held at New York this week to arrange the final details. Common iron is selling at 1.57½c, and soft steel bars at 1.55c to 1.65c, both prices being on mill shipments.

STRUCTURAL MATERIAL.—The demand for bridge material continues, and sales of over 6,000 tons were placed in this market last week, most of it for track elevation work. No large buildings were contracted for, but there are several in the market which will be placed within a short time. Quotations are as follows: Beams, 15 inches and under, 1.65c to 1.70c; 18 inches and over, 1.75c to 1.80c; angles, under 3 inches and over 6 inches, 1.75c to 1.80c; 3 inches to 6 inches, 1.65c to 1.70c. Sheared plates, 2.25c to 2.30c; universal plates, 2.25c to 2.30c; tees, 1 70c to 1.75c; zees, 1.65c to 1.70c. Small lots from stock are quoted at ¼c to ½c higher.

BILLETS AND RODS.—No sales of either billets or rods were made in the Chicago district last week. Prices are nominally as follows: Bessemer billets, $25.50 to $26.50; open-hearth billets, $28; rods, $32.50.

PLATES.—The demand for plates continues large, and quite extensive sales were made by the local stores last week. Mills are still not in position to accept business for anything like close delivery. The local mills have taken some business for the last half of the year in the week. Quotations are unchanged as follows: Tank plates, 2.25c to 2.30c; flange steel, 2.35c to 2.45c; marine steel, 2.45c to 2.55c; fire box steel, 3c and upwards.

SHEETS.—Business was limited to small lots, with very few mill orders placed. Not many mills are willing to take business, and buyers do not find it an easy matter to place their orders with mills. Store business last week was excellent.

Quotations are made at 2.75c to 2.85c for No. 27 common, and 70 and 7½ to 70 and 10 off for galvanized.

RAILS AND TRACK SUPPLIES.—The local mills closed no business last week, with the exception of a few small orders for light rails. We quote: Standard section rails, $25 to $26; light rails, $25 and upwards; steel splice bars, 1.40c to 1.50c; track bolts with square nuts, 1.80c to 1.90c; hexagon nuts, 1.90c to 2c; spikes, 1.55c to 1.60c.

MERCHANT STEEL.—The demand is still good, and sales last week were limited only by the inability of the mills to accept all business offered to them. Store business was large, and bids fair to continue so. Quotations are as follows: Open-hearth spring, tire and machinery steel, 2.40c to 2.45c; smooth finished machinery steel, 2.45c to 2.55c; smooth finished tire steel, 2.25c to 2.35c; tool steel, 6c to 7.50c; specials, 10c and upwards.

SCRAP.—The demand for scrap from mills is still light, and is not likely to grow until after the bar mill deal is completed. Foundry grades of scrap are in large demand, with good sales last week, and a shortage of some varieties. Prices are unchanged. Dealers' selling prices are as follows:

Old iron rails, gross,	$17 00@$18 00	Axles, net	$17 00@$17 50
Old steel rails, long, gr.	11 75@ 12 00	Cast borings, net	6 00@ 6 50
Old steel rails, short	11 00@ 11 50	Wrought turnings, net	7 25@ 7 75
Old wheels, gross	16 50@ 17 00	Axle turnings, net	9 50@ 10 00
Railroad forge, net	15 00@ 15 50	Mixed steel, gross	8 00@ 8 50
Dealer's forge, net	11 50@ 12 00	Stove plates, net	8 00@ 8 50
No. 1 mill, net	9 50@ 10 00	Heavy melting steel, gr.	11 00@11 50
Heavy cast, net	13 00@ 13 25	Old iron splice b., net.	16 00@16 25
Malleable cast, net	8 50@ 9 50		

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World*, 27 VINCENT ST., April 12.

Latest information from the Ishpeming district is that the miners' strike has been declared off by the union and all efforts to prevent non-union men from working or to coerce them into joining the union have ceased. The men, outside of the leading trouble-makers, are now at work and for the present no serious apprehension of interruption from this cause is entertained. The late opening of navigation is still the important element in the ore situation. At this time last year boats were on their way for ore, but the probabilities are that three weeks will yet elapse before any ore will be loaded at Lake Superior docks, though work in Lake Michigan may open earlier. All depends upon the amount of ice-thawing weather that is crowded into the remainder of April. Ten days of spring weather, with south winds, could work a vast change in present conditions. Though it has been taken for granted for many weeks, the formal transfer of the Queen group of mines at Negaunee to the Oliver Iron Mining Co. has only been made this week. The lease of Corrigan, McKinney & Co. is given up and a new 20-year lease is made with the various fee-owning interests. This transaction puts the leading Pittsburg interest in possession of the largest non-Bessemer hematite property in the region. Since 1886 the output of the Queen group has been 2,918,000 tons. Further special interest is shown in Lake Superior iron mining stocks, Cleveland-Cliffs and Republic receiving most attention of late.

PIG IRON.—The fact that 35,000 tons of Bessemer iron in excess of the March production was shipped from valley furnaces is a significant index to the situation in that department of the market. Bessemer converters are making outputs equal to the greatest records and in some cases exceeding them, and the current production of Bessemer iron is evidently inadequate to the demands upon it. The first of the Lorain stacks will be in blast early in May and the second about a month later; but at least one producer of Bessemer iron in the valley is only awaiting the arrival of non-Bessemer ores to turn on to foundry iron. The merchant furnace is thus very much of a factor and will continue to be. And in the case of Bessemer furnaces, the requirements of low phosphorus pig iron have been such as to keep two at least on that grade. An inquiry for 4,000 tons of low phosphorus metal was on the market this week. In the case of the furnaces working on basic and foundry irons, there is no chance that they will be added to the Bessemer column. Struthers Furnace is out for relining, as is River, of Cleveland. The foundry iron trade is quiet, without any change in prices. The buying is principally of lots for delivery in the next three months, indicating a volume of foundry work in excess of that counted on when contracts of last fall were made. The fact of the increase in the melt of iron is brought out also by direct inquiry, indicating that in Northern Ohio the amount of iron passing through the cupola was 10 per cent more in the first quarter of this year than in the last quarter of 1898, and 40 per cent more than in the first quarter of 1898. The usual quotation for No. 2 foundry is $14.50 at valley furnace, and $15 for No. 1. Little is being done on deliveries for the latter part of the year. There has been no buying of pipe iron, thus far, by the new cast pipe company, most of the plants having considerable stocks that were taken at the low prices. Lake Superior charcoal is still in demand beyond the ability of the furnaces to supply it. We note a sale at $17 Lake Erie dock. Cleveland prices follow:

Bessemer	$15 15	Valley Scotch No. 1	$15 75@16 00
No. 1 Strong Foundry	15 65@15 90	Valley Scotch No. 2	15 25@15 50
No. 2 Strong Foundry	15 15@15 40	Gray Forge, valley	14 00@14 50
No. 3 Foundry	14 75@15 00	Lake Superior Charcoal	16 50@17 00

FINISHED MATERIAL.—Some demand for shapes for local buildings and for shapes and plates for bridge work is noted. Prices on small lots of plates that are occasionally worked in by the mills are from 2c to 2.25c, the urgency of buyers' necessities in such cases leading them to pay whatever price is named. Some mills are rather falling behind than gaining on their order books, and one large Pittsburg mill is practically filled up to December. Steel car requirements will absorb a large part of the new plate capacity soon to be available at Pittsburg. In sheets prices have not changed, but mills are very loth to book orders. One large mill has temporarily withdrawn from the market. Mill sales are on the basis of 2.55c to 2.60c Pittsburg, for No. 27, but Cleveland sales from stocks are at 2.80c to 2.90c. Bars are quiet, but prices are very firm. Cleveland sales of bar iron have been made at 1.55c, and 1.50c valley is the mill quotation. Steel bars are quoted 1.50c to 1.60c, Pittsburg, though mills are filled quite beyond the middle of the year.

CINCINNATI.

April 6.

The market is quieter, but not less firm. Prices are steady and the feeling of the iron masters is as fixed as ever. Nothing has occurred to shake quotations, sellers report, and, while the market is quieter, yet it is only quieter comparatively because there has been a steady run of small business at top prices. In the last day or two some very good inquiries are reported. Rogers, Brown & Co. make this comment on the situation: The attitude of the pig iron producers in all districts is alike. They feel that prices current are reasonable and satisfactory and there is no disposition on their part to exact what might be called fancy figures. Prices on pig iron, when compared with prices of its products, are exceedingly conservative and consumers generally realize that a retrospect of any decade reveals average prices above the figures prevailing to-day. Until lake navigation opens, and some furnaces that are now preparing to go into blast shall have iron to sell, it is quite likely that for "spot" iron prices above the present market may between this and June be realized on certain qualities and grades which are extremely scarce. High numbers of some charcoal irons are at present not at all obtainable. The general situation is that consumers are fairly well provided for, and the comparative quiet of the market is an exceedingly welcome condition and serves to avert an unmanageable market which would have been upon us had the extraordinary demand continued. The business of the week under review has been of fair volume and every industry using pig iron seems to be working to utmost capacity. Shipments of all grades and every class of iron are being urged forward, which is a healthful indication that the various manufacturers of the country are in great activity. We quote for cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $15.25; No. 2, $14.25 to $14.75; No. 3 $13.75 to $14.25; No. 4 and gray forge, $13 to $13.50; mottled, $13 to $13.50; No. 1 soft, $15.25; No. 2 soft, $14.25 to $14.75; Lake Superior coke, No. 1, $16.25 to $16.50; No. 2, $15.75 to $16; Hanging Rock charcoal No. 1, $17 to $18; Jackson Co. silvery No. 1, $17 to $17.50; Standard Georgia car wheel, $15.75 to $16.50; Lake Superior charcoal, $18.75 to $19.25.

DILWORTH, PORTER & CO., Pittsburg, spike manufacturers, have advanced wages 10 per cent.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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RAILWAY CONSTRUCTION FOR 1899.

The *Railway Age* concludes from data it has collected concerning projected railroad lines and those under construction, that there will be built in the United States in 1899 not less than 5,000 miles of new railway. Considering that in each of the four years beginning with 1894 less than 40 per cent of this mileage in new road was built, and that last year, when the wave of prosperity that began with agriculture was rising in other industries, only about 60 per cent of 5,000 miles was laid in new track, such a contribution as is predicted for 1899 will be a very plainly recognized factor even in the present flood tide of prosperous business. The *Railway Age* estimates that 5,000 miles of new track represents an investment of $50,000,000, and means the development of new country, the building of new communities and the increasing of all values. The operation of that mileage of road means the permanent employment of 25,000 men and is thus a permanent addition to the productive wealth of the country. Put in terms of 100-lb. rails it would mean more than 850,000 tons.

It goes without saying that the conditions that have prevailed for the past 18 months, leaving out the few months of uncertainty that preceded the declaration of war last year, are calculated to give vitality to a large number of projects for the development of the country through railroad building. The South and Southwest, which contribute the greater part of the new mileage of 1899, are the sections in which we may expect the principal railroad enlargement of the immediate future to take place. If railroad building has out-run the needs of the people in the more thickly populated portions of the country, it is not yet an overdone industry in these two sections. In a thoughtful article on the "Signs of the Times," about four years ago, Mr. Edward Atkinson inclined to the view that beginning with 1896 the average for the 15 years following 1880, of 6,000 miles a year of new railroad, would be resumed. He cited Texas as an example of under-development in railroads. To approach the mileage of certain sections of the Middle West would call for 40,000 miles of railroad, while little more than 10,000 miles existed. Georgia and Alabama were cited as productive States in which railroad construction had been retarded. The prediction Mr. Atkinson made was in these terms:

> It follows that dating from Jan. 1, 1896, it will become necessary to add railroad mileage to our present service at the rate of not less than 5,000 or 6,000 miles a year for many years to come, in order to give a partly adequate service to these very productive areas of our National domain which are now suffering from their own discredit. [Legislation hostile to railroads, and in the case of the far Western States, the election of Populists to the Senate, as referred to in a previous portion of the article.—ED.] Not less than 100,000 miles of new railroad must be constructed in the next 15 or 16 years. This extension will not consist of great through lines, which may be called the warp of our system, but of cross lines and connections, which make the weft. Bearing in mind the relative resources of the two sections, one may contrast the present totally inadequate railroad service of Texas, of less than 10,000 miles, with that of an area but a trifle greater in the States of Ohio, Indiana, Illinois, Iowa and Kansas, which have 44,000 miles.

Mr. Atkinson's prediction encountered some serious and unlooked for obstacles in the early portion of the period it covered; and looking back over 1896, 1897 and 1898, it is not difficult to see why capital hesitated to go into new railroad lines and extensions of old ones. But the estimate presented by our railroad contemporary would indicate that 1899 is to approach closely the average of the 15 years between 1880 and 1895. Moreover, judging from the *Railway Age's* statistics, which show 590 lines projected or building, their plans calling for 40,563 miles, the next few years—barring the extraordinary—will see further considerable additions to new track. It may be that the railroad demand will take a larger place as a contributor to iron and steel consumption than many have been ready to assign it since it ceased to be an index of the iron trade.

BESSEMER AND OPEN-HEARTH STEEL.

The statistics of production of Bessemer and open-hearth steel in the United States and Great Britain are interesting, not only for a comparison of the outputs of the two countries, but for a study of the relative advance of the converter and open hearth in each. We give in the following table the statistics for 1898 and for 10 years preceding, and append, for comparison, the statistics for 1880 to show of how relatively recent development is the steel industry on both sides of the water:

PRODUCTION OF BESSEMER AND OPEN-HEARTH STEEL IN THE UNITED STATES AND GREAT BRITAIN—GROSS TONS.

	United States.		Great Britain.	
	Bessemer.	Open Hearth.	Bessemer.	Open Hearth.
1888	2,511,161	314,318	2,012,894	1,292,742
1889	2,930,204	374,543	2,140 793	1,429,069
1890	3,688,870	513,232	2,014 843	1,564,200
1891	3,247,417	579,753	1,642,005	1,514,538
1892	4,168,435	669,889	1,500,810	1,418,830
1893	3,215 686	737,890	1,493,454	1,456,309
1894	3,571,313	784,936	1,535 384	1,575,318
1895	4,909,126	1,137,182	1,535.225	1,754,737
1896	3,919,906	1,298,700	1,815,842	2,317,555
1897	5,475,315	1,608,671	1,884,155	2,601,806
1898	6,609,017	2,220,492	1,759,386	2,806,600
1880	1,074,261	100,851	1,044,382	251,000

It will be seen that the open-hearth steel industry

practically doubled its output in the United States between 1895 and 1898. That there is good prospect of overtaking Great Britain within a year or two is indicated by the large additions to open-hearth plant now under construction at Pittsburg and Birmingham. Further extensions are entirely probable when plans of the Republic Iron & Steel Co., the new rolling mill consolidation, are matured. The American Steel & Wire Co. will also be a builder of basic open-hearth plant in the coming year.

Moreover, our growth in open-hearth steel is not at the expense of Bessemer tonnage. It is true that the percentage of open-hearth steel was fractionally larger last year than ever, being a trifle over 25 per cent of the total, against 22 per cent in 1897; but in 1896 the open-hearth percentage was only a shade under 25 per cent. There is no indication yet of the rapid displacement of Bessemer steel by open-hearth that has been predicted now and again. What will take place when open-hearth steel more closely approximates the cost of Bessemer is a development for the future. Great tonnage as a divisor of fixed charges still throws the balance of economy on the side of Bessemer.

As a matter of interest, in connection with the comparison between the steel production of the United States and the United Kingdom, the production of Germany is added. In 1894 the German production of Bessemer steel—almost entirely basic Bessemer—was 2,342,161 tons, and of Siemens-Martin steel, 899,111 tons; making a total of 3,241,272 tons. A gradual advance was made in the next four years until in 1898 the total was 3,606,737 tons of Bessemer and 1,459,159 tons of Siemens-Martin—an aggregate of 5,065,896 tons. Germany passed Great Britain as a steel producer in 1897, with a total of 4,538,673 tons, against 4,485,961 tons in the United Kingdom. Last year Germany increased the lead, her total of 5,065,896 two being 500,000 tons in excess of that for Great Britain. In France the production of steel is relatively unimportant. The tonnage of Bessemer ingots in 1898 was 905,995; and of open-hearth ingots, 535,638. The total by both processes was 1,441,633 tons, as against a total of 1,235,213 tons in 1897.

CONCERNING THE CONSOLIDATIONS.

"The survival of the fittest" will never find a truer application than in the case of the indusrtial consolidations. Time and earning power put values in their right relation. Stocks that under the support of well organized pools are now aligned with those whose way has been made on their merits, will be shaken from their undeserved places when the speculative craze has passed and the test of every-day operation comes.

Gov. Flower suggests in an interview, referring to the consolidated corporation as the "modern scientific application of finance and industry," that with its general adoption we shall see the day when the workman's savings will be fearlessly invested in the stock of the concern in which he is employed. "We shall then see," he adds, "the practical application of those harmonious relations between capital and labor that will redound to the general benefit of the community." The fact that any man can go into the market and invest in the stock of the company that employs him, or of any company whose operations promise a good return on his money, is one of the desirable possibilities of the listing of stocks, so that they may be bought or sold on any day. But before the time comes when employes will seek this form of investment for their savings the new industrial machine must undergo some important changes. There must be some method of guaranteeing to the public that the representations now anonymously published concerning the earning capacity of stocks and the status of the properties are true. To-day, in the economy of the average industrial consolidation there is no such thing as authoritative information to the investing public. We believe if effort were put forth seriously to make the stock of a soundly organized and well conducted company a favorite security for people of small means, the movement could be made to succeed; but as it is to-day the average trust stock is not calculated to invite the savings of men of modest means. The prime object of these companies is profit — oftentimes primarily the profit of those from without, who see in some particular industry material for a financial and industrial coup. The very thing about these securities that makes them the mediums of speculators' operations takes from them the element of safety which any popular security must have. There is no doubt that if any effort were made to enlist the interest of the multitude in trust securities such provisions would be adopted as would disarm much of the hostility that now finds expression, often with no good reason. One of the best bids for public favor is a practical demonstration of the theoretical advantage of consolidation — the lowering of prices and a saving to the consumer. But time must be allowed for such an effect to show itself. Almost invariably the immediate result of consolidation is an advance in price.

If Gov. Flower and some of his associates should address themselves seriously to the problem of making some of the consolidations attractive and fairly remunerative investments for the persons employed by these corporations, they will certainly have rendered a service that cannot easily be measured. Yet for the present we can scarcely see in these aggregations the germ of any such large contribution to the solution of the labor problem as Gov. Flower suggests.

Will the strength of the consolidated companies in the iron trade be used for war or for peace? The question is frequently asked. On the theory of the European powers that thorough preparedness for war is the surest guaranty of peace, the consolidatons are well equipped to prevent destructive competition. Two of them have practically complete control of production in their particular lines. But suppose some other strong organization, that has abundant sources of raw material and blast furnaces and steel plant, should decide that its interests would be served by entering the line of finished production, on which one of these two depends? Noth-

ing to hinder, is the prompt answer. True, if the sacrifice of the earning value of important properties is counted as nothing. It is to be remembered that the greater the equipment and the larger the resources the more terrific the struggle for supremacy, if it ever comes. And from the standpoint of prosperous times, with a demand beyond what the mills can supply, it does not seem at all imminent. Yet the possibilities of a contest for tonnage, in the days that always come sooner or later, are not to be overlooked in searching for the permanent equilibrium of the new forces that are dominating the iron trade. Some recent signs point to a policy on the part of the big companies that will conserve values rather than destroy them. Understandings are better arrived at and kept, where the interests are few and powerful. And it is to be considered that whatever theories may be held concerning trusts as a high product of modern industrial evolution, these companies have been organized for money-making. They cannot fight and make money. The instinct of self preservation is not lessened, moreover, by increasing the size of the corporation. The arrangements already made in the iron trade and others under negotiation would lead to the conclusion that these vast and powerful industrial machines are not to be dashed against one another. Rightly managed they may be made the balance wheel of the great iron industry, saving it from erratic and irregular movements and preserving the right relation between supply and demand.

The American Steel Hoop Co.

The formation of the American Steel Hoop Co., as noted in these columns last week, is about completed, and the subscription books will be opened in New York or Chicago early next week, when the prospectus will be issued. The capitalization will be $33,000,000, of which between $29,000,000 and $30,000,000 will be issued at once, the balance remaining in the treasury for future use. The purchase of all the plants embraced was made on a strictly cash basis, and the former owners will be allowed to subscribe for stock only as seems desirable to the promoters. It is claimed that as high as 15 per cent has been bid in New York for subscription privileges. All the plants manufacturing hoops, bands and cotton ties are included, as heretofore enumerated, including the three furnaces at Etna, Pa., of the Isabella Furnace Co. A large part of the product of these furnaces is gray forge iron. Moore Bros. and others connected with the National Steel Co. have been active in the formation of the American Steel Hoop Co., and members of the firm of Naylor & Co. have assisted in the preliminaries. A working arrangement is being completed with the National Steel Co. for raw material. The cotton tie mill of the Federal Steel Co., at Joliet, Ill., is not in the new consolidation, but will work harmoniously with it.

National Steel Co. Ore Negotiations.

It is learned on the best authority that the National Steel Co. has almost completed a deal whereby it will acquire the Oliver one-sixth interest in the Carnegie-Oliver ore arrangement. This share of the ore was formerly consumed by the Edith Furnace in Allegheny and the Rosena Furnace at New Castle, of the Oliver & Snyder Steel Co., and a part of it went to New Castle interests now in the National Steel Co. The Edith Furnace was sold some time ago to the American Steel & Wire Co., along with the Hainsworth Steel Works, no part of the ore going with the sale. The Rosena Furnace is to go to the National Steel Co. along with the Oliver share in the ore arrangement. The acquisition of this ore interest would be an important move for the National Steel Co., and, with the 1,250 acres of Connellsville coking coal land recently purchased from H. C. Frick, will give it a good command of raw materials. There is good reason to believe that the plans of the company, when fully carried out, will place it in a very strong position, not only with regard to the supply of its raw materials, but as regards the disposition of its finished product to allied interests in such a way that a steady business will be assured under all market conditions.

Expansion of present plants so as to give the company entire independence of the ore and pig iron market are on the program of the National Steel Co. Enlargements of the Buhl Steel Co.'s open-hearth plant at Sharon, Pa., are contemplated. It is expected, also, that an additional furnace will be built at Bellaire, O., and another at Mingo Junction, and that the Shenango Furnaces will become two independent stacks, by the addition of necessary stoves and blowing capacity. This would give three simultaneously effective furnaces instead of two.

THE negotiations for the combination of all the coal producers in the Pittsburg district have been making very satisfactory progress in the past two weeks, and it is probable the deal will be put through. While there will be no change effected so far as competition with the other districts is concerned, the combine will be in a position to secure much more satisfactory treatment from the railroads, about which there has been much complaint, and will be able to deal with a number of problems in connection with the Pittsburg coal trade in a satisfactory way.

THE J. H. Baker Mfg. Co., mentioned some time since, has secured the tract of land at Hite Station, Pa., on the West Penn road, formerly occupied by a Standard oil refinery, and will erect on it a plant to manufacture a number of wrought iron specialties, controlled by patents recently issued to Mr. Baker, who is the patentee of a large number of chain making patents recently sold.

THE Pittsburg Sheet Mfg. Co., referred to some weeks ago as intending to build a sheet mill at Shousetown, Pa., on the P. & L. E. road, has been organized with the following officers: R. A. Wilson, president; Lewis W. Washington, vice-president and manager; A. C. Warner, treasurer, and E. E. Hicks, Canton, O., secretary. The directors will further consist of T. L. Woodward and Irwin Marshall.

THE Ohio Valley Iron Co. has been organized with $150,000 to operate Jefferson Furnace, at Steubenville, O., on which an option has been secured. Those interested are Chas. F. Banning, and S. G. Cooper, of Naylor & Co., Pittsburg and New York; D. J. Sinclair, of Steubenville, and B. M. Caldwell, John A. Topping, J. J. Holloway and George A. Dean, of the Aetna-Standard Iron & Steel Co., Bridgeport, O.

ARTHUR SEATON, of Mercer, Pa., representing a party of Pittsburg and local capitalists, has purchased 108 acres of land about five miles west of New Castle, Pa., on the Pittsburg & Lake Erie and the Pittsburg & Western, on which to erect a bridge building works.

APPLICATION will be made May 1, for the incorporation of the Pittsburg (Pa.) Brake Shoe Co., by Frank Moore, Philo N. French, superintendent of the A. French Spring Co., John M. Patterson and George A. Dickson, under the general Pennsylvania laws for the incorporation of metal companies.

THOS. HACKETT, 431 4th ave. Pittsburg, is offering for sale a complete sheet mill, consisting of three mills, one being a combination mill for sheets and plates 44 inches wide, including engine power, stretcher, extra rolls, etc.

THE American Tin Plate Co. this week started eight more mills at the Shenango works, New Castle, Pa., making 16 of the 30 in operation.

THE Sharpsville (Pa.) Wire Specialty Co. is increasing capacity.

PERSONAL.

M. McMurray has been appointed general superintendent of the Joliet plant of the Federal Steel Co., to succeed C. L. Miller, resigned.

H. M. Curry, who has been in California, for some months, has returned to Pittsburg.

Andrew Carnegie expects to sail for Europe April 26. His latest gift, announced last week, is $50,000 for a public library at McKeesport, Pa.

W. R. Warner, of Warner & Swasey, Cleveland, sails for Europe early in May on a business trip.

Wallace C. Andrews, who perished in the fire that destroyed his residence at New York, last week, was for a number of years identified with the coal and iron interests of the Mahoning valley. He was associated for years with his brother, Chauncey H. Andrews, W. J. Hitchcock and others in the Andrews & Hitchcock Iron Co.

John Evans, for 17 years assistant superintendent of the Brier Hill Iron & Coal Co., Youngstown O., is to be superintendent of the West Duluth blast furnace, recently acquired by John M. Thomas and associates.

Henry W. Oliver's name will be borne by one of the largest ore carriers of the lakes, now building at Lorain, O., for the Wilson Transit Co.

John Birkinbine, the well known engineer, has removed his offices to the Odd Fellows' Temple, Broad and Cherry sts., Philadelphia. In an announcement of the change the lines of service in which Mr. Birkinbine has been active for years are stated—hydraulic, metallurgical and mining engineering, valuations and arbitrations.

John W. Cloud, formerly Western sales agent of the Westinghouse Air Brake Co., and secretary of the Master Car Builders' Association, has been appointed London representative for the Westinghouse air brakes. The Parliamentary bill making the use of air brakes compulsory on British roads has lately received a serious backset.

George A. Dean, who has been furnace superintendent at Mingo Junction for 28 years, for the Junction Iron & Steel Co., and later for the Aetna-Standard Iron & Steel Co., has resigned. J. S. Oursler, of Pittsburg, has been named by the National Steel Co. furnace management as his successor.

R. Midzutani and Hyo Hamada, of the Mitsu Bishi dock yards and engine works of Nagasaki, Japan, have been in Pittsburg conferring with the Carnegie Steel Co., Ltd., regarding shipbuilding material. They own the largest shipbuilding plant in Japan, and have been buying all their material in the past from England and other European countries.

Joseph McClure, connected with the industrial and commercial development of the Shenango valley for over 60 years, died near Sharon, Pa., March 29, aged 89 years. In 1846 he and his brother John McClure formed a partnership with B. B. Vincent and David Himrod under the firm name of Vincent, Himrod & Co., and erected and operated the first blast furnace in Sharpsville.

Republic Iron and Steel Co.

It has been the expectation that the Republic Iron & Steel Co. would organize at New York this week, but thus far the meeting has not been held, though those in charge of the enterprise are hard at work on unfinished details. It is understood that for all the rolling mill properties included the stock of the new company is to be given, cash being paid for material and stock on hand at the various plants The mention of the name of Myron C. Wick, of Youngstown, for the presidency has brought out a statement from Mr. Wick, that even though the place were offered him, as it had not been, he could not accept on account of his health. Some mention has been made the past week, of Geo. D. Wick, president of the Mahoning Valley Iron Co., in connection with the presidency.

Deals have not yet been closed for all the mills named in the prospectus of the new company. In one or two instances, where there are allied consuming companies, the offer of stock in the new company has not been regarded sufficiently attractive to lead to the selling of the rolling mill from under the other enterprises.

The single Bessemer steel plant acquired is that of the Union Steel Co., at Alexandria, Ind. This consists of two 5-ton converters, which were to have been operated three years ago to supply steel to the American Tin Plate Co., at Elwood, Ind., and to the wire and wire nail plant at Anderson, but were never started. They have not been used since their removal from the Valley Steel Co.'s plant at Belleville, Ill., in 1895, and it is not probable that the new company will operate them. The open-hearth capacity available consists of the two 30-ton furnaces of the Birmingham Rolling Mill Co., Birmingham, Ala., and the two 15-ton furnaces of the Minnesota Iron & Steel Co., at Columbia Heights, Minneapolis, the total capacity being 50,000 tons a year. Apart from this the company will be a buyer of steel.

The coke property acquired is that of the Connellsville Coke Co., an identified interest of the Atlantic Iron & Steel Co., whose furnace and rolling mill are taken over. It is a plant of about 100 ovens. The Croton Lime Co., of New Castle, owned by officers of the Atlantic Iron & Steel Co., is also taken.

To Facilitate Pittsburg Steel Exports.

Another important step has been taken in the development of the export trade in iron and steel. Pittsburg steel manufacturers who have been shipping a greater or less tonnage abroad for the past two years are arranging with the Pennsylvania Co. for a regular freight train to the Atlantic Coast, carrying export steel products exclusively. By having an agent at the seaboard to engage ocean tonnage as needed, the expectation is that prompt transfers will be made from cars to shipholds, and the annoying delays avoided, that heretofore have interfered seriously with shipments to Europe. Sometimes these delays have amounted to weeks. The new move is proof of the systematic and energetic effort that is being expended upon the development of the export trade, with a view to its establishment on a basis of permanence and solidity.

National Tube Co.

The details of the pipe and tube combination have been completed so far as the arrangements with the individual owners are concerned. But one producer, the Tyler Tube & Pipe Co., Washington, Pa., will be on the outside. This concern manufactures tubes only, and altogether from charcoal iron. The promoters are now hard at work making arrangements whereby the National Tube Co. shall be advantageously placed as regards the securing of that part of the raw material which is not manufactured by the constituent companies, and it is understood that this part of the arrangements is about completed, while further than this the effort is being made to restrict as much as possible the supply so that there will be no temptation to outside capital to erect competing plants. Very little can be learned as to the personnel of the new management, beyond the fact that the president will be E. C. Converse, now vice-president and general manager of the National Tube Works Co.

Iron and Steel Roofing Consolidation.

The National Metallic Roofing Co., just incorporated with a capital stock of $125,000, will embrace practically all the manufacturers of corrugated roofing. The capital will be increased later, probably to about $4,000,000. The organization has been accomplished through the efforts of Maj. Harlan P. Lloyd, of Cincinnati. It is stated that the management of the plants embraced will remain with the original owners. The concern is closely identified with National Steel Co. interests and will doubtless be associated with the sheet consolidation now being organized.

THE Totten & Hogg Iron & Steel Foundry Co., Pittsburg, manufacturing rolls, rolling mill machinery and engines, have advanced their employe's wages 10 per cent.

A MEETING of the blast furnace workers of the Mahoning and Shenango valleys is to be held next Saturday at Youngstown, to complete their organization and press the demand made some time ago for an advance of 10 per cent in wages.

THE Braddock plant of the American Steel & Wire Co., idle last week on account of a break in the machinery, was started in full operation Monday last.

DAVIES CASTING APPARATUS.

Five or six forms of apparatus for sandless casting of pig iron have been exploited in the past few years. In all there are points of resemblance. Two or three of the systems are almost identical in the main; the really patentable feature in each being the method of coating the molds by the use of a wash. Conveyors, with sprocket wheels and chains, are essential parts of several of the well known devices. The machine illustrated in the accompanying cuts is patented by Roderick W. Davies, of Warren, O., formerly superintendent of the Aetna Machine Co., of that place. In brief the molds in which the molten iron is poured are arranged side by side on a circular carrier or wheel which is gradually revolved. The wheel as shown in Fig. 1 is composed of a series of I-beams radiating from a hub a^1 and united near and at their outer ends by inner and outer concentric rings, a^2 a^3. A series of hangers b depends from the beams of the carrier, the hangers supporting the journals of wheels b^1 which travel on a circularly arranged rail b^2. The method of revolving the carrier W suggested in the cut is a motor for rotating a gear-wheel x, in the cross-sectional view Fig. 2, which meshes with teeth on the under side of the outer ring a^3. The form of the molds B is indicated in Figs. 3 and 4, the latter being a cross-section on the line 4-4 of Fig. 3. Each mold is of approximately rectangular shape and is composed of a body b^3, formed with opposite chambers or cavities b^5, of concave form in cross-section, these chambers extending the full length of each mold. From the outer stud of each mold lateral arms C project. These contact with a stationary post D. Thus the mold is given a partial turn. As there are four faces or cavities to the mold, provision is made so that a quarter turn is made in dumping the pig iron, the four chambers of the mold thus receiving the molten iron in rotation.

Fig. 1.

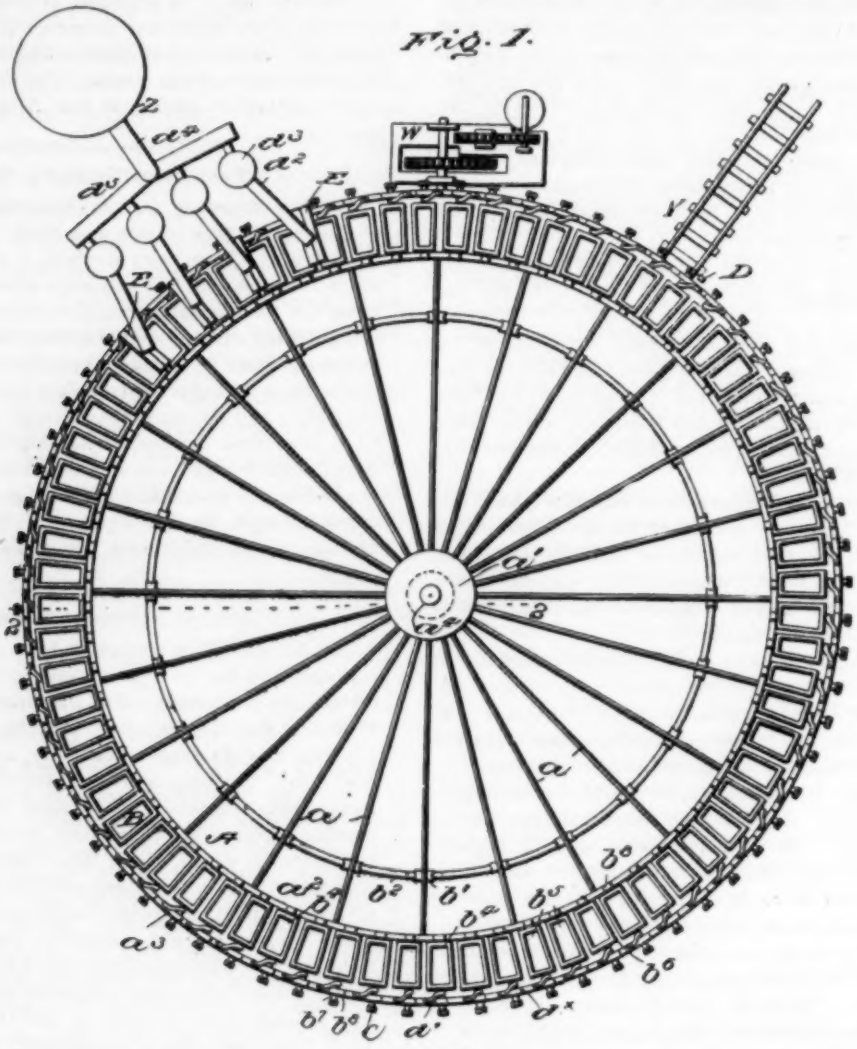


Fig. 2.

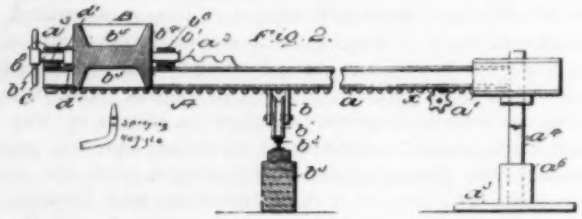


Fig. 3.

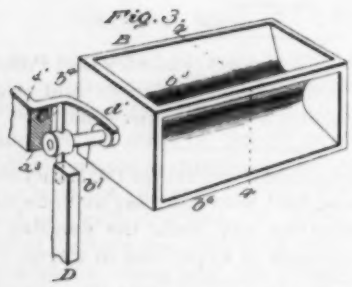
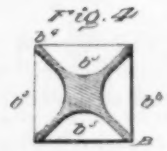


Fig. 4.



In practice the molten metal will be deposited in the molds as they pass beneath the spouts of the ladles, the carrier being revolved at a rate of about 10 feet to the minute; but this speed may be varied. The pouring of the metal is continuous until the supply is exhausted, and the rotation of the mold carrier is likewise continuous. As the filled molds travel toward the point of discharge (the carrier being moved in the direction of the arrow), they may be sprayed with water to aid in cooling the metal, so that a solid pig will be delivered at the point of discharge. As each mold reaches the latter point its depending arm will contact with the post D, resulting in the turning of the mold and the dumping of the pig therefrom. When but two arms are provided for each mold, the latter is completely inverted by the contact of an arm with the post, aided by the weight of the pig, causing its previously lowered side to be faced upward to receive the molten metal when the mold again comes beneath the discharge spout of the ladles; but when it is desired to use successively the four chambers or cavities of each mold as receivers for the molten metal, the mold will be given but a quarter turn and the pig will fall therefrom by its own weight.

The under sides of the several molds after the upper side has been filled may, while the carrier is being revolved, be sprayed with a mixture of fire clay and lime water or any other suitable fluid to prevent the metal from adhering. A device for this purpose is now being built, which the inventor claims is simple and inexpensive. The coating device is not included in the patent upon the machine, but is the subject of a separate invention. The machine is covered by foreign patents and its early introduction in Europe is promised. The Davies Casting Machine Co. is now building its apparatus at the Dover Furnace of the Penn Iron & Coal Co., at Canal Dover, O.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

Oxygen in Steel.—*Stahl und Eisen*, March 15, has an article on the above subject. In view of the importance of the matter, a full translation is given herewith. L. Romanoff, of Moscow, writes: While it is known that the presence of traces of oxygen in steel has a very injurious influence on its behavior in the rolls, yet oxygen determinations are seldom carried out at the mills. The reason for this is doubtless the difficulty experienced in carrying out the work, and the absence of the complicated equipment necessary for the purpose. After we had rebuilt our Siemens-Martin furnaces we repeatedly burned our steel, and as a consequence went into the determination of oxygen in the soft varieties very thoroughly. Steel furnaces usually take 10 per cent of air above their theoretical requirements in order to produce complete combustion. Our system (Vacelet) requires a rapid burning of the gases, the fuel (residues of naphtha) being introduced without previous treatment, and hence we must have an excess of air which often reaches 25 per cent above the theoretical. This great excess was the cause of the burning of the steel.

Prof. Ledebur was the first to work out a practical method of determining oxygen in iron and steel. He made a number of trials showing the amounts present in burnt material and the influence exerted upon its physical properties. Unfortunately work in this direction has made but little headway since, two or three papers by Prof. Ledebur, studies by Gladkys and others, is all that can be recorded. A discussion of the current methods of determining oxygen will reveal the fact that each of them is subject to serious errors and is complicated by difficult manipulation. There are three groups of these methods.

The first group depends upon the property of dry chlorine to act upon iron without attacking its oxides. A stream of dry chlorine gas is passed over the red hot borings. In this way the iron is removed as a chloride. Unfortunately, however, with the oxide of iron there remain behind also the carbon, manganese oxide, and other chemical combinations not affected by chlorine. The second group of methods makes use of solvents such as copper sulphate, or chloride, iodine, bromine, etc. These solvents have the objection that they leave behind in addition to the oxide of iron, the carbon, manganese oxide, and compounds of phosphorus and sulphur. The third method mentioned by Ledebur consists of passing a stream of dry pure hydrogen over the red hot borings. This reduces the oxide to metallic iron, and the water thus formed is weighed. Clean borings are essential. The trouble with this method is that the presence of oxide of manganese affects the results, the oxygen dissolved in the steel alone being wanted, for according to Ledebur oxide of manganese may be present in steel in mechanical admixture.

By combining these three groups of metals very accurate results could be obtained, but the process would be too complicated for general daily use. Tucker recommends the following method: Steel borings are mixed with powdered coal and heated to redness in a crucible. The difference of the weights of the steel before and after give the oxygen, this going off as carbonic oxide. Aside from the fact that 2.2 lbs. of borings are required for this method, the dissolved gases remaining in the borings are neglected, the consequence being that results are often 50 to 100 per cent too high.

After I had tried all the above methods I came to the conclusion that Ledebur's method of heating the borings in a stream of dry pure hydrogen was the only one applicable. The preliminary heating of the steel in a current of nitrogen, while insuring greater accuracy, is cumbersome and only allowable when the nitrogen used is absolutely free from oxygen. Prof. Ledebur made use of this nitrogen process in order to get rid of any carbohydrates coming from the drills. While I have omitted this detail my results do not differ materially from those of Ledebur. I clean my borings with alcohol and ether and dry them in the dessicator. In some cases I have heated the borings in a current of nitrogen; the reasons for this will be given later on. The presence of carbohydrates in steel during the reduction by hydrogen I do not attribute to oils and fats coming from the drilling process, but to entirely different causes. Of this more later on.

It is unnecessary to go into all the details of process in the determinations given hereafter, these being explained fully by Ledebur, and were carefully followed by myself. In connection with the results obtained from soft steels I give a column showing the behavior of the material in the rolls. While these notes are not too accurate by any means, they are nevertheless important enough to stand on their merits. Furthermore it is interesting to note the relation of the oxygen in burned steel to its specific gravity. In making comparisons based upon the specific gravity, I did not depend so much upon the proportion of the foreign elements present, which after all are too small to influence results very much, but I looked especially for the condition or final form of the oxygen present in the finished heat. The bath of steel, which is very hot and contains carbon and oxygen, cannot remain quiescent, and consequently carbonic oxide will form, and this is naturally influenced by the temperature and the amounts present; the final outcome being the formation of carbonic oxide as long as oxygen is present, which in effect means a formation of carbonic oxide proportional to the amount of oxygen in the bath.

Steel cannot give off all the occluded carbonic oxide upon cooling, and hence a certain amount will always be present as a mechanical admixture, the ingots being more or less unsound. To prove this I took some pulverized steel and sifted it in two sieves of 20 and 10 mesh, thus obtaining a lot of uniform sized grains. Next I removed all air bubbles by shaking in water, and used the air pump. Ingot steel was used for this purpose, a rolling would have destroyed the original structure.

No	C.	P.	Mn	S.	O.	Sp. gr.	Remarks.
.....	.08	.07	.20	.08	.29	7.69	Scrapped.
496	.107	.04	.57	.03	.19	7.79	Surface badly cracked in rolling.
498	.23	.01	.54	.03	.15	7.85	For telegraph wire, 11.09 resistance.
572	.25	.02	.55	.04	.29	7.72	" " 11.28 "
516	.10	.04	.50	.07	.11	7.92	Good.
503	.10	.08	.55	.06	.25	7.84	Surface badly cracked in rolling.
526	.095	.02	.37	.06	.23	7.78	" " " " "
540	.10	.04	.48	.07	.16	7.82	Scaly.
547	.095	.04	.49	.05	.11	.....	Good.
550	.105	.05	.49	.03	.14	.....	Slight surface cracks on rolling.
551	.09	.06	.32	.04	.16	7.87	" " " " "
553	.095	.08	.39	.04	.13	7.80	" " " " "
555	.10	.05	.44	.03	.13	7.87	" " " " "
570	.095	.02	.....	.....	.03	8.08	Good.
581	.105	.06	.46	.....	.09	7.97	"
583	.10	.04	.42	.03	.02	8.08	"
616	.085	.01	.37	....	.00	.....	"
654	.11	.....	.....	.....	.00	.....	"
576	.095	.06	.50	.....	.....	7.76	Scaly.
750	.09	.035	.24	.05	.....	7.77	Scrapped.
.....	.43	.02	.61	.03	.07	.....	Cast steel.
.....	.....	.....	.....	.....	.05	.....	Cast iron.

From this table we see: (1) The percentage of oxygen varies from 0 to .29 per cent, which latter figure seems to be the maximum, and apparently substantiates the claim of Ledebur that 0.29 per cent O or 1.30 per cent FeO is the saturation point of iron with the oxide. (2) A steel to roll properly should not contain over 10 per cent oxygen, and finally (3) that the amounts of oxygen present are closely related with the specific gravity. Thus a steel with .11 per cent oxygen which rolled well corresponded to a minimum specific gravity of 7 90 Steel which was just passable had oxygen .11 to .20 per cent and specific gravities of 7.90 down to 7.80. Steel containing over 20 per cent oxygen and a specific gravity below 7.80 had to be scrapped as unfit to roll. It is also interesting to note that Nos. 498 and 572 intended for drawing telegraph wire gave difference in electrical resistance. Heat No. 498 with .15 oxygen and a sp. gr. of 7.85 upon being drawn down to a wire 1-6 inch in diameter gave a resistance of 11.09, which passed the Government requirements, while No. 572 on being drawn down to the same size, with its oxygen .29 per cent and the sp. gr. 7.72, gave a resistance of 11.28 or a variation of 0.19 from the standard required. Apparently this condition can be explained by the smaller density of the steel, which in turn is a consequence of the dissolved oxygen. The observed specific gravities corroborate this also.

In order to get some further information on the effects of oxygen I undertook a series of oxygen determinations on samples gathered during the making of a heat. The primary object sought was the reason why one grade of steel contained more than another. Incidentally I obtained some data on the action of the ferromanganese added to the bath. Heat

No. 616 was selected for this purpose. This charge consisted of 5,400 lbs. steel scrap and 1,800 lbs. "Novorossijsk" pig iron. The composition was selected to give a minimum of silicon, sulphur and phosphorus, in order to remove the influence of these elements as much as possible. A sample was taken every 10 minutes. The first addition of 27 lbs. ferro-manganese was made an hour after taking the first sample, and the second addition of 54 lbs. ferro-manganese was made 20 minutes later. The heat was just melted when the first sample was taken (5:50 P. M.), and it was tapped 1 hour and 25 minutes later. The results are shown graphically, the time forming the abscissa and the amount of oxygen present the ordinate of each point. I have already mentioned above that in reducing oxidized steel in a current of hydrogen it loses more weight than corresponds to the weighed water. This phenomenon I attributed to the dissolved gases in steel which are likewise given off during the operation, and by plotting this curve of dissolved gases on the diagram, its relation to the curve of dissovled oxygen is readily seen.

In studying ,the curve of oxygen we see that it soon reaches its maximum of .39 per cent and then gradually drops proportionately with the oxide of iron in the bath, this, by the way, at the expense of the carbon present. This gradual decrease goes on until the first portion of ferro-manganese is added, which drops the oxygen line sharply, and then the second addition of ferro-manganese wipes out the oxygen altogether. The action of ferro-manganese consists in the destruction of oxide of iron with the formation of manganese oxide which goes into the slag.

Were we to continue the heat, the moment the manganese disappears the oxygen would at once reappear and the result is a burnt steel, for carbon is also about gone and the refining is practically ended. This explains why soft steel can be burned so much more readily than other grades carrying manganese, or even sulphur, phosphorus and silicon. Adding ferro-manganese too early or in too small quantities would send it virtually into the slag and not protect the iron from oxidation, which means a considerable amount of dissolved oxygen in the final steel. During the period of boiling the carbonic oxide formed takes with it the gases dissolved during the melting by a species of mechanical action. The additions of ferro-manganese, however, arrest this process and prevent the separation of carbonic oxide by sending the oxygen into the slag as a manganese oxide. We observe finally that during the tapping of the charge the curve of dissolved gases takes a heavy drop which corresponds to a giving off of gases d re to the cooling of the bath, a fact readily observed when casting ingots. It is therefore advisable to allow the bath to boil well, for this aids in making sound ingots. We are not very far off in supposing that the difference of weights observed in the oxygen determinations is due to this removal of occluded gases, for we know that hydrogen is a very penetrating element when in contact with red hot borings.

In conclusion I will add a few remarks about the methods I had to make use of. First I noticed that the weight of water obtained by reducing the oxides in steel by a current of hydrogen never corresponded with the loss of weight on the part of the borings, this latter being always greater than the first. Not only must we take into account the loss of occluded gases, but I find that sulphur and phosphorus give volatile compounds with hydrogen. This, by the way, was shown by Thidliers while refining steel with a stream of moist hydrogen. Dry hydrogen is not so active, but the result of it all is that the accuracy of the whole method is very questionable. Prof. Ledebur refers to the formation of carbohydrates, attributing them to the oil from the drills, which he claims it is impossible to remove. To look into this more fully, I made the following experiments: I took a sample of .15 carbon (soft) steel with a piece of .43 carbon (hard) steel and a piece of cast iron with 2.90 graphite and .48 combined carbon. First I washed them in alcohol and ether, dried and then ignited them. The results were as follows: The mild steel gave off .18 volatile and .09 non-volatile hydrocarbons, the hard steel similarly .05 and .02, and the cast iron .05 and .02 per cent. From this it will be seen that ether does not positively clean the borings, and that the carbohydrates might have been introduced by the drills. I next ignited the borings in a current of hydrogen, and finding evidence of the presence of carbohydrates I set to work determining the carbon of the samples. Being certain that all the carbohydrates had been removed by the ignition of the borings in nitrogen, a further evidence of them must be attributed to the action of the hydrogen on the carbon present. The following were the results: The .15 per cent carbon soft steel dropped to .11 carbon the .43 per cent steel to .37 per cent, and the cast iron retained its combined carbon, but lost .45 per cent of its graphite.

One would say that a protracted ignition would have reduced the carbon contents still more. The carbohydrates seemed to be formed very rapidly at first and then came off slowly, but never ceased to do so altogether. Inasmuch as carbon makes more or less stable combinations with ironit is not to be wondered at that hydrogen splits some of them up earlier than others. The fact that some of these carbohydrates are volatile and others are not, shows up a new source of error in Ledebur's method of determining the oxygen present, for the liquid hydrocarbons are weighed with the water. As soon as a better method is devised I will go into this subject deeper and strive to find out the effect of oxygen on a variety of steels made by the various processes. My special thanks to Mr. R. Vacelet for advice and encouragement in this work.

L. ROMANOFF,
Chemist to the Moscow Metal Mfg. Co.

Moscow, January, 1899.

Stahl und Eisen sent the above to Prof. Ledebur for criticism (with the consent of the author) and received the following reply:

When I made my experiments on oxygen in steel 17 years ago, I shared the then current belief that the oxygen present could only be due to dissolved FeO. Since then, however, I have come to the conclusion that the addition of ferromanganese gave rise to an oxide of manganese not insoluble in iron and certainly present if the bath is poured soon after the addition. To determine this oxygen in combination with manganese, and possibly also with silicon, we have no present means. Chlorine is useless, for the combinations taking place when iron is heated in it depend too much upon temperature conditions. FeO will lose some iron and leave $Fe_2 O_3$. FeO Cl and P will make a chloride and a phosphate of iron, etc. To determine the oxygen in this residue is an almost hopeless task. I still consider my method, devised after numerous failures as sufficient to determine the oxygen in combination with the iron, and cannot support the conclusions of Romanoff that oxygen even in the minutest quantities is deleterious to the rolling qualities of a steel. My observations in practice speak against this. I have found that oxygen below .10 is practically harmless and less dangerous to good rolling than a corresponding amount of sulphur.

The value of a preliminary heating of the borings in nitrogen seems to be rather proven if anything by the results of Romanoff. The percentages of oxygen found by him are higher than my own. I found only .25 per cent O in an overblown basic Bessemer steel before the addition of ferromanganese, and not over .12 per cent in a mild steel low in manganese. Romanoff found .39 per cent O in O. H. steel during the melting and .29 per cent in the rolled bar. Even if there were no organic compounds in the borings there could be some hygroscopic moisture present only to be removed by the ignition.

I cannot endorse the theory of considerable amounts of carbonic oxide retained by the steel mechanically when it sets. Romanoff refers to the famous investigations of Mueller, who, however, found the gases in blowholes, and readily removable upon boring. To determine the oxygen in steel requires very fine borings, and these it seems could hardly retain 0.65 per cent of their weight of occluded gases. If these gases were not dissolved, but mechanically held, we must admit that they are in a gaseous form. If carbonic oxide, .65 per cent of the weight would mean a volume 40 times as large as the borings; if hydrogen, 500 times the volume of the borings. To believe this would require better proof. Mueller found the maximum gas contents to be 0.6 times the volume of the iron.

The results obtained by heating the three samples of borings do not agree with other observations. Forquignon found that heating white iron 62 hours in a current of hydrogen (at dark red heat) changed a good proportion of the com-

bined carbon to what he called graphite, and only upon heating 46 hours at bright red heat was .41 per cent of the carbon removed. Romanoff per contra obtains results in a half hour which show a loss of 25 per cent of the carbon in the steels, and the very refractory graphite of a cast iron has been reduced by 20 per cent, leaving the combined carbon unchanged (?) This requires further proofs and looks quite unacceptable.

While I agree with Romanoff's conclusions only partially, I nevertheless can only praise his efforts to obtain light upon this important subject, and hope he will soon devise a method to satisfactorily determine the total oxygen contents of a steel so that we can better judge its influence upon steel than we do now.

A. LEDEBUR.

COMPETITION IN CAST IRON PIPE.

At the April meeting of the Foundrymen's Association at Philadelphia, last week, Mr. P. D. Wanner, of Reading, Pa., made some comment, as printed below, on the over-development of cast-iron pipe manufacture in the United States. Mr. Wanner's remarks are appropriate in view of the recent consolidation of cast iron pipe companies. It will be recalled that the Eastern pipe foundries, with one exception, were not included in the American Pipe & Foundry Co. Up to the present time the Reading Foundry Co., Ltd., of which Mr. Wanner is president, is on the outside. It will be noted that Mr. Wanner is of the opinion that any hope of success in cast iron pipe manufacture for the future must be based on a consolidation including all the manufacturers in that line:

"On May 11, 1892, I read a paper on cast iron pipe at a meeting of the Board of Trade, of Reading, Pa., which was published and freely commented upon, in which I said, among other things, the following:

"'Cast iron pipe commenced to be used for water works about the beginning of the present century. But 16 of these works were constructed in this country prior to the year 1800, and 87 up to the year 1850. The trade developed slowly until after 1850, when the large increase of water and gas works made the demand for pipe proportionately large. The panic of 1857, followed by the civil war, interrupted it materially, but after the war it became flourishing and to such an extent that even the panic of the 70's did not seem to affect it until the year 1878. After that, owing probably to the over-building of water and gas works and the high price of pig iron, the trade remained quiet until the summer of 1881, when it became very active and remained large and profitable until the end of 1887. These were seven years of unprecedented prosperity for the pipe manufacturers but with them disappeared the large profits of the business . . . . and yet from that time to the present the demand for pipe was large and the number of water and gas works increased in the aggregate to 2,200 of water and 1,200 of gas, having a mileage of pipe of over 50,000, a distance twice around the world. The trade was also increased by a large demand from railroads, cities and towns for drainage, culvert and sewer purposes, but owing to the large number of new pipe foundries constructed throughout the country of late, and the increased capacity of the older ones, the demand fell short of the supply. In other words, we have had overproduction. All the new foundries built since the boom of the 80's could have been spared and the money saved to the investors. Its present condition is full of anxiety and has brought ab ut some very desperate movements, particularly on the part of Southern establishments. . . . View the situation as we may, it clearly indicates that this once prosperous and profitable trade will become uncertain and of doubtful tenure, and that location, equipment and management will be essential elements tributary to the success of pipe foundries hereafter. . . . . I believe that the several sections of the country will have their respective works to which their trade will be necessarily confined, and even in that case such territory will probably have to abandon some of its present works.'

"I said this all but seven years ago. Few, if any, predicted the future of the trade better, and none did more to uphold prices during these years of depression than I; and having dismantled two pipe foundries (one of which was among the very first in the country) I should at least be permitted to run one foundry either in or outside of the consolidation. I believe, frankly, that the only hope for success in this trade for the future will lie in a combination that shall control the product and business of them all either directly or indirectly. I have been in favor of such consolidation or control from the time I became interested in it. Its product is bulky and could naturally be limited to the several sections of the country or divisions of territory. I therefore maintained that it would be better that several sections should work together or even in case of a few concerns here and there than that they should all compete apart. This and all governments were created and are upheld by necessity. It will be so with both capital and labor and all trade or manufacturing interests in the future. It has been truly said that business is war, and to make it a success war-like methods will have to be resorted to, and success will be on the side of those who have the largest guns or aggregation of capital; in other words, a combination of the greater part of the trade will be able to dictate prices and a line of behavior to those outside, or crush them. It is no longer the survival of the fittest, but of that which can hold out best and longest.

"The panic of the seventies and consequent depression suggested a combination to the pipe trade, and accordingly a notice was issued to all the pipe men of the country to meet on the 17th of December, 1879, at the Continental Hotel, Philadelphia, Pa , at which the following, according to the minutes of the meeting, was agreed upon after a two-days' session, by all except the Warren Foundry & Machine Co., of Phillipsburg, N. J., Matthew Addy, of the Cincinnati & Newport Pipe Co., Cincinnati, O., acting as chairman, and Dr. J. D. White, of the Camden Iron Works, Camden, N. J., acting as secretary, viz.:

"We, the undersigned cast iron pipe manufacturers of the United States hereby agree to form an association for mutual benefit and protection, and more especially for the objects mentioned below:

"First—To provide some method to secure more remunerative prices.

"Second—To divide the work or assets realized for the letting of the work on a basis equitable to all.

"Third—To prepare uniform specifications under which we shall all pledge ourselves to bid at public lettings.

"Fourth—To prevent the expansion of present shops or the building of new ones."

The company above referred to not attending, nor agreeing to join, the object of the meeting failed. With the splendid revival of the trade during the eighties no further effort was made to combine, outside of what was done by the Western pipe men, and later by the Southern. The want of a sufficient demand and consequent decline in prices prompted a meeting of the Eastern pipe men, for which a notice was issued to meet at the Astor House, New York, Dec. 20, 1892, which was attended by representatives from the Warren Foundry & Machine Co., of Phillipsburg, N. J.; McNeal Pipe & Foundry Co., of Burlington, N. J.; Buffalo Cast Iron Pipe Co., of Buffalo, N. Y.; Utica Pipe & Foundry Co., of Utica, N. Y.; Reading Foundry Co., Ltd., Reading, Pa.; R. D. Wood & Co., of Philadelphia; Jackson & Woodin Mfg. Co., of Berwick, Pa., and also, by letter, the National Pipe & Foundry Co., of Scottdale, Pa., and the Emaus Pipe Foundry Co., of Emaus, Pa.

"The meeting was organized by the election of Wm. Runkle, of the Warren Foundry & Machine Co., as president; A. H. McNeal, of the McNeal Pipe & Foundry Co., as vice-president; George B. Hayes, of the Buffalo Pipe & Foundry Co., as treasurer, and P. D. Wanner, of the Reading Foundry Co., Ltd., as secretary. A constitution and by-laws were adopted. The association was named the Eastern Cast Iron Pipe Founders' Association, the object being 'the advancement of the interests of the cast iron pipe trade, the promotion of good will and harmony among its members, the encouragement of uniform customs and concerted action, and the collection of all information on matters of importance to the business,' also the proper division of territory for the trade at large.

"This association failed likewise for want of cohesiveness. Thus it appears that both of the efforts to combine, above referred to, failed because of a few concerns either opposing or failing to join.

"In my opinion, it would have been of very great service to them had they been united and worked together. There would have been fewer losses, fewer foundries, less trouble and worriment and more money for all of them. In all financial, industrial and commercial affairs the order of the day is in the direction of co-operation and combinations' in spite of all attempted legal restrictions, political denunciations or other useless impediments. Their object can be defeated only by their own indiscretion, such as unwise or over-capitalization or a demand for unreasonable profits. The whole movement is a result of the evolution and progress of the advanced state of business civilization."

Second Series of A. F. A. Tests.

In our issue of March 9 we gave the results of the tests of the first series of bars cast under the auspices of the American Foundrymen's Association's committee on a standard system of test bars for cast iron, Dr. Richard Moldenke, of Pittsburg, chairman. In the tables herewith are given the results of transverse, tensile and compression tests of bars made in Cast B, the iron being such as is used for dynamo frame castings. As indicated by the cuts accompanying the tables, the bars were both square and round, machined and unmachined. The committee reserves comment on the results, for the foundrymen's convention of next month, in Pittsburg, but it has prepared the following memorandum:

Cast B, Dynamo Frame Iron.—This set of 198 bars, cast vertically and at the same time, in accordance with the specifications of the American Foundrymen's Association

TABLE 1.—*Transverse Test.*

SERIES B.—Dynamo Frame Iron. Bars in green sand and not machined.

No.	Approx. Cross Section. Inches.	Actual Size. Depth. Inches.	Actual Size. Width. Inches.	Breaking Strain. Lbs.	Deflection. Inches.
281	.5 x .5	.53	.57	380	.190
282		.52	.55	320	.200
283		.54	.56	460	.210
284		.54	.55	340	.190
285	1 x 1	1.04	1.04	2,140	.130
286		1.01	1.03	2,580	.110
287	1.5 x 1.5	1.52	1.52	8,090	.102
288		1.57	1.53	7,920	.102
289	2 x 2	2.03	2.04	16,180	.101
290		2.01	2.03	14,920	.087
291	2.5 x 2.5	2.57	2.50	30,500	.103
292		2.51	2.50	27,680	.101
293	3 x 3	3.03	3.02	45,790	.099
294		3.03	3.02	45,660	.102
295	3.5 x 3.5	3.52	3.54	68,470	.091
296		3.57	3.56	70,140	.092
297	4 x 4	4.00	4.06	over 100,000	*
298		4.02	4.05	over 100,000	†

* .055 in. at 100,000 lbs.
† .056 in. at 100,000 lbs.

TABLE 2.—*Transverse Test.*

SERIES B.—Dynamo Frame Iron. Bars in green sand and machined.

No.	Approx. Original Cross Section. Inches.	Actual Size as Machined. Inches.	Breaking Strain. Lbs.	Deflection. Inches.
299	1 x 1	.5 x .5	250	.299
300			270	.287
301	1.5 x 1.5	1 x 1	2,080	.170
302			2,400	.159
303	2 x 2	1.5 x 1.5	6,640	.142
304			6,390	.146
305	2.5 x 2.5	2 x 2	15,390	.119
306			16,400	.116
307	3 x 3	2.5 x 2.5	27,770	.106
308			28,469	.091
309	3.5 x 3.5	3 x 3	44,070	.093
310			46,180	.090
311	4 x 4	3.5 x 3.5	66,240	.052
312			63,100	.059

TABLE 3.—*Transverse Test*

SERIES B.—Dynamo Frime Iron. Bars in dry sand and not machined.

No.	Approx. Cross Section. Inches.	Actual Size. Depth. Inches.	Actual Size. Width. Inches.	Breaking Strain. Lbs.	Deflection. Inches.
313	.5 x .5	.53	.53	320	.220
314		.50	.56	340	.230
315		.52	.52	280	.190
316		.55	.56	240	.160
317	1 x 1	1.07	1.01	2,300	.110
318		1.05	1.06	2,660	.105
319	1.5 x 1.5	1.55	1.54	7,470	.100
320		1.58	1.53	7,100	.091
321	2 x 2	2.09	2.03	16,100	.087
322		2.07	2.03	16,230	.091
323	2.5 x 2.5	2.56	2.51	27,840	.112
324		2.51	2.54	29,800	.105
325	3 x 3	3.09	3.10	49,360	.102
326		3.00	3.06	46,050	.100
327	3.5 x 3.5	3.58	3.61	74,920	.090
328		3.62	3.53	72,450	.091
329	4 x 4	4.15	4.00	99,650	.069
330		4.16	4.02	99,820	.072

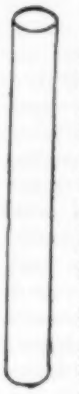
TABLE 4.—*Transverse Test.*

SERIES B.—Dynamo Frame Iron. Bars in dry sand and machined.

No.	Approx. Original Cross Section. Inches.	Actual Size as Machined. Inches.	Breaking Strain. Lbs.	Deflection. Inches.
331	1 x 1	.5 x .5	220	.300
332			200	.294
333	1.5 x 1.5	1 x 1	2,020	.182
334			2,000	.180
335	2 x 2	1.5 x 1.5	6,470	.123
336			6,000	.130
337	2.5 x 2.5	2 x 2	15,840	.118
338			15,430	.114
339	3 x 3	2.5 x 2.5	25,840	.103
340			27,780	.100
341	3.5 x 3.5	3 x 3	43,000	.086
342			40,370	.082
343	4 x 4	3.5 x 3.5	60,620	.051
344			62,510	.049

TABLE 5.—*Transverse Test.*

SERIES B. Dynamo Frame Iron. Bars in green sand and not machined.



No.	Approx. Diameter. Inches.	Actual Size. Depth. Diameter Inches.	Actual Size. Width. Inches.	Breaking Strain. Lbs.	Deflection. Inches.
345	.56	.59	.52	250	.100
346*		.....	.....	.....	.....
347		.58	.59	220	.106
348		.56	.58	200	.107
349	1.13	1.17	1.18	2,490	.120
350		1.15	1.18	2,120	.130
351	1.69	1.74	1.74	7,130	.081
352		1.73	1.74	7,020	.077
353	2.15	2.26	2.26	15,680	.083
354		2.26	2.27	15,880	.089
355	2.82	2.86	2.84	31,770	.102
356		2.84	2.89	31,170	.100
357	3.38	3.53	3.48	46,790	.098
358		3.44	3.41	49,620	.091
359	3.95	4.01	4.02	71,440	.095
360		4.01	4.00	75,600	.092
361	4.51	4.61	4.64	100,120	061
362		4.62	4.62	over 100,000	†

* Defective—Shot.
† .044 in. at 100,000 lbs.

TABLE 6.—*Transverse Test*

SERIES B. Dynamo Frame Iron. Bars in green sand and machined.

No.	Approx. Original Diameter. Inches.	Actual Diameter as machined. Inches.	Breaking Strain. Lbs.	Deflection. Inches.
363	1.13	.56	230	.310
364			230	.302
365	1.69	1.13	2,040	.168
366			2,190	.152
367	2.15	1.69	6,170	.113
368			6,070	.118
369	2.82	2.15	11,040	.079
370			11,090	.082
371	3.38	2.82	23,530	.092
372			24,830	.098
373	3.95	3.38	41,520	.072
374			41,050	.074
375	4.51	3.95	66,090	.069
376			64,210	.061

committee on standardizing the testing of cast iron, furnished 262 test pieces and 286 separate tests. This set was presented to the committee by the Westinghouse Electric & Mfg Co., in the interest of the trade. The cast was made by Mr. Jos. S. McDonald. Cast B illustrates a class of castings which must machine readily, be soft in sections, little over one-half inch thick and yet sound when 14 inches is reached. About 45 per cent scrap is carried in the mixture. A good transverse strength and resilience are essential, tensile strength being less so. The composition of this cast as taken from the 1-inch dry sand square bar is as follows:

TABLE 7.—*Transverse Test.*

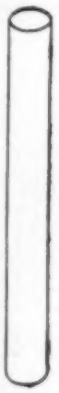
SERIES B.—Dynamo Frame Iron. Bars in dry sand and not machined.

No.	Approx. Diameter. Inches.	Actual Size. Depth. Diameter. Inches.	Width. Diameter. Inches.	Breaking Strain. Lbs.	Deflection. Inches.	Contraction. Ins.
377	.56	.52	.58	200	.204	.....
378		.58	.60	190	.203	.....
379		.53	.60	200	.190	.....
380		.51	.58	180	.220	.....
381	1.13	1.18	1.13	2,610	.110	.....
382		1.14	1.12	2,240	.120	.....
383	1.61	1.77	1.74	8,080	.085	.....
384		1.72	1.74	7,480	.082	.....
385	2.15	2.34	2.29	15,620	.087	.12
386		2.26	2.26	15,260	.078	.12
387	2.82	2.87	2.89	31,900	.107	.....
388		2.86	2.84	30,770	.111	.....
389	3.38	3.42	3.44	48,280	.093	.....
390		3.48	3.49	47,810	.089	.....
391	3.95	3.97	4.02	72,530	.095	.....
392		3.99	4.02	74,400	.094	.....
393	4.51	4.60	4.62	over 100,000	*	.....
394		4.60	4.62	over 100,000	†	.....

* .040 in. at 100,000 lbs.
† .044 in. at 100,000 lbs.

TABLE 8.—*Transverse Test.*

SERIES B. Dynamo Frame Iron. Bars in dry sand and machined.



No.	Approx. Original Diameter. Inches.	Actual Diameter as machined. Inches.	Breaking Strain. Lbs.	Deflection. Inches.
395	1.13	.56	210	.311
396			240	.320
397	1.69	1.13	1,820	.178
398			1,750	.162
399	2.15	1.69	5,880	.114
400			6,030	.112
401	2.82	2.15	11,220	.088
402			10,840	.091
403	3.38	2.82	23,740	.089
404			24,420	.088
405	3.95	3.38	39,220	.075
406			39,570	.078
407	4.51	3.95	62,880	.052
408			63,120	.058

TABLE 9.—*Tensile Test.*

SERIES B.—Dynamo Frame Iron. Bars in green sand and not machined.

No.	Approximate Cross Section. Inches.	Actual Area, in Square Inches.	Breaking Strain. Lbs.	Ultimate Strength per Sq. In. Lbs.
409	.5 x .5	.28	4,910	17,540
410		.29	4,920	17,600
411		.26	4,440	17,080
412		.28	4,490	16,180
413	1 x 1	1.01	15,900	15,740
414		1.04	15,150	14,570
415	1.5 x 1.5	2.26	28,450	12,590
416		2.24	29 470	13,150
417	2 x 2	4.02	47,930	11,920
418		4.01	45,120	11,000
419	.5 x .5	.30	5,050	16,830
420		.31	4,990	16,100
421		.31	5,030	16,220
422		.29	4,650	16,030
423	1 x 1	1.01	15,700	15,540
424		1.04	14,980	14,400
425	1.5 x 1.5	2.30	30,280	13,170
426		2.31	31,090	13,460
427	2 x 2	3.97	41,030	10,330
428		3.97	42,480	10,700

TABLE 10.—*Tensile Test.*

SERIES B.—Dynamo Frame Iron. Bars in green sand and machined.

No.	Approximate Original Cross Section. Inches.	Area as Machined, Square Inches.	Breaking Strain. Lbs.	Ultimate Strength per Sq. In. Lbs.
429	1 x 1	.25	4,790	19,160
430		.25	4,020	16,080
431	1.5 x 1.5	1.00	14,220	14,220
432		1.00	15,790	15 790
433	2 x 2	2.25	24,930	11,080
434		2.25	32,580	14,480
435	1 x 1	.25	4,030	16,120
436		.25	4,860	19,440
437	1.5 x 1.5	1.00	15,360	15,360
438		1.00	14,580	14,580
439	2 x 2	2.25	25,970	11,540
440		2.25	28,720	12,760

TABLE 11.—*Tensile Test.*

SERIES B.—Dynamo Frame Iron. Bars in dry sand and not machined.

No.	Approximate Cross Section. Inches.	Actual Area, in Square Inches.	Breaking Strain. Lbs.	Ultimate Strength per Sq. In. Lbs.
441	.5 x .5	.27	4,510	16,700
442		.30	4,840	16,130
443		.29	4,840	16,700
444		.28	4,440	15,710
445	1 x 1	1.03	15 120	14,680
446		1.03	15,480	15,030
447		1.02	15,550	15,240
448		1.01	15,570	15,410
449	1.5 x 1.5	2.25	29,150	12,950
450		2 27	30,980	13,640
451	2 x 2	3.92	41,940	11,210
452		3.98	43,810	11,060
453	.5 x .5	.28	4,420	15,800
454		.25	4,150	16.600
455		.27	4,280	15,850
456		.28	4,090	14,610
457	1 x 1.	1.03	15,320	14,870
458		1.09	16,700	15,320
459		1.04	15,790	15,180
460	1.5 x 1.5	2.24	28,840	12,870
461		2.23	26,650	10,610
462	2 x 2	4.00	45,480	11,370
463*		.....	.....	.....

* Dirty iron.

TABLE 12.—*Tensile Test.*

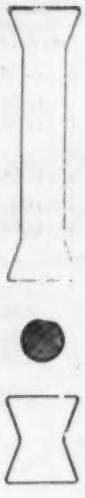
SERIES B.—Dynamo Frame Iron. Bars in dry sand and machined.

No.	Approximate Original Cross Section. Inches.	Area as Machined, Square Inches.	Breaking Strain. Lbs.	Ultimate Strength per Sq. In. Lbs.
464	1 x 1	.25	4,460	17,840
465		.25	4,750	19,000
466	1.5 x 1.5	1.00	14,690	14,690
467		1.00	15,180	15,180
468	2 x 2	2.25	26,000	11,560
469		2.25	28,460	12,650
470	1 x 1	.25	3,990	15,960
471		.25	4,200	16,800
472	1.5 x 1.5	1.00	15,330	15,330
473		1.00	12,940	12,940
474	2 x 2	2.25	25,920	11,520
475		2.25	28,530	12,680

Total carbon,	3.82 per cent.
Graphite,	3.23 "
Silicon,	1.95 "
Manganese,	.39 "
Phosphorus,	.405 "
Sulphur,	.042 "

TABLE 13.—*Tensile Test.*

SERIES B.—Dynamo Frame Iron. Bars in green sand and not machined.



No.	Approximate Original Diameter. Inches.	Actual Area in Sq. In.	Breaking Strain. Pounds.	Ultimate Strength, Lbs. per Square Inch.
476	.56	.25	4,020	16,080
477		.25	4,410	17,640
478		.26	4,280	16,000
479		.28	4,600	16,430
480	1.13	.96	15,220	15,860
481		1.00	15,870	15,870
482	1.69	2.26	28,590	13,090
483		2.26	29,700	13,140
484	2.15	4.03	47,040	11,670
485		4.05	46,120	11,140
486	.56	.26	4,450	17,110
487		.26	4,176	16,040
488		.26	4,170	16,040
489		.28	4,380	15,650
490	1.13	1.00	15,310	15,310
491		.99	14,180	14,320
492	1.69	2.26	30,380	13,440
493		2.31	32,260	13,970
494	2.15	4.00	42,200	10,550
495		4.14	50,180	12,120

TABLE 14.—*Tensile Test.*

SERIES B.—Dynamo Frame Iron. Bars in green sand and machined.

No.	Approximate Original Diameter. Inches.	Area as Machined. Square Inches.	Breaking Strain. Pounds.	Ultimate Strength, Pounds per Sq. In.
496	1.13	.25	4,810	19,240
497		.25	4,690	18,760
498	1.69	1.00	14,760	14,760
499		1.00	15,990	15,990
500	2.15	2.25	27,900	12,400
501		2.25	26,510	12,670
502	1.13	.25	4,220	16,880
503		.25	4,800	19,200
504	1.69	1.00	14,340	14,340
505		1.00	13,400	13,400
506	2.15	2.25	30,910	13,740
507		2.25	30,950	13,760

TABLE 15.—*Tensile Test.*

SERIES B.—Dynamo Frame Iron. Bars in dry sand and not machined.

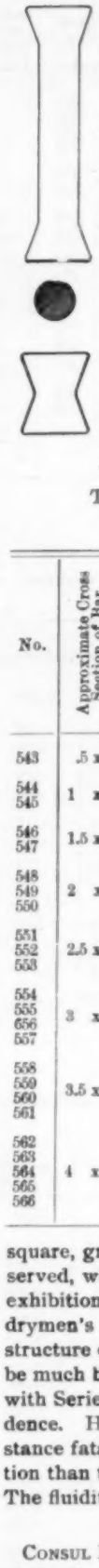
No.	Approximate Original Diameter. Inches.	Actual Area in Sq. In.	Breaking Strain. Pounds.	Ultimate Strength, Lbs. per Sq. In.
508	.56	.26	4,090	15,730
509		.24	4,000	16,670
510		.24	4,170	17,790
511*		.....	.....	.....
512	1.13	1.01	16,650	16,480
513		.96	14,850	15,470
514		1.02	16,700	16,370
515	1.69	2.27	30,240	13,320
516		2.25	29,220	13,000
517	2.15	4.03	44,780	11,110
518		4.00	43,650	10,910
519	.56	.25	4,450	17,800
520		.26	4,190	16,110
521		.27	4,280	15,810
522		.20	3,520	17,600
523	1.13	1.03	16,650	16,160
524		1.02	16,340	16,510
525		1.10	17,790	16,170
526		1.14	18,470	16,200
527	1.69	2.33	34,590	14,840
528		2.27	30,640	13,500
529	2.15	4.09	46,680	11,410
530		4.01	43,210	10,770

*Lost.

The cross section of the square bars and the round is approximately equal for the relative sizes. The machined bars were turned or planed to the size indicated, for purposes of comparison. In the transverse tests the supports were all 12 inches apart. The fresh fracture of each size of round and square, green sand and dry sand transverse bar was preserved, will be mounted in a case, and is expected to be on exhibition at the coming convention of the American Foundrymen's Association, in Pittsburg. From the physical structure of these bars it is seen that the larger sizes would be much better available for standard tests than was the case with Series A, shrinkage spots not being very much in evidence. However, there is a slight tendency to pipe, a circumstance fatal to the value of a test bar cast in any other position than the vertical. But two bars proved unserviceable. The fluidity strips ran up nearly full.

TABLE 16.—*Tensile Test.*

SERIES B.—Dynamo Frame Iron. Bars in dry sand and machined.



No.	Approximate Original Diameter. Inches.	Area as Machined. Square Inches.	Breaking Strain. Pounds.	Ultimate Strength, Pounds per Sq. In.
531	1.13	.25	4,390	17,560
532		.25	4,040	16,160
533	1.69	1.00	15,780	15,780
534		1.00	14,400	14,400
535	2.15	2.25	29,280	13,010
536		2.25	29,740	13,220
537	1.13	.25	4,670	18,680
538		.25	4,000	16,000
539	1.69	1.00	15,770	15,770
540		1.00	13,940	13,940
541	2.15	2.25	28,570	12,700
542		2.25	31,010	13,790

TABLE 17.—*Compression Test, ½-inch Cubes.*

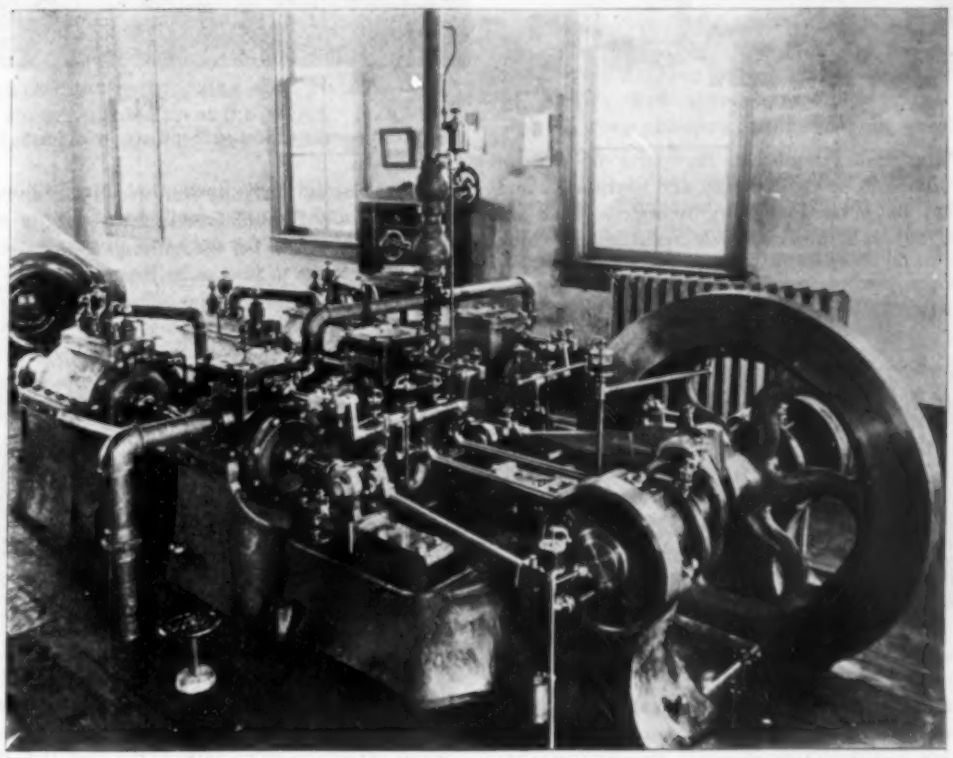
SERIES B.—Dynamo Frame Iron.

No.	Approximate Cross Section of Bar. Inches.	Crushing Strength in Pounds. Middle ½ Inch.	First ½ Inch from Edge.	Second ½ Inch from Edge.	Third ½ Inch from Edge.	Fourth ½ Inch from Edge.	Remarks.
543	.5 x .5	38,360	.....	.....	.....	.....	The cubes were cut from the square bars cast in dry sand (vertically) and were compressed along the length of the original bar. Test pieces were cut along a line at right angles to the sides of the bar. The value of the middle cube is repeated where it rounds out the series.
544	1 x 1	23,000	.....	.....	.....	.....	
545		.....	27,440	.....	.....	.....	
546	1.5 x 1.5	20,980	.....	20,980	.....	.....	
547		.....	24,820	.....	.....	.....	
548	2 x 2	18,130	.....	.....	.....	.....	
549		.....	21,640	.....	.....	.....	
550		.....	.....	18,740	.....	.....	
551	2.5 x 2.5	15,060	.....	.....	15,060	.....	
552		.....	18,270	.....	.....	.....	
553		.....	.....	15,940	.....	.....	
554	3 x 3	13,790	.....	.....	.....	.....	
555		.....	17,000	.....	.....	.....	
556		.....	.....	14,410	.....	.....	
557		.....	.....	.....	13,900	.....	
558	3.5 x 3.5	13,160	.....	.....	.....	13,160	
559		.....	15,970	.....	.....	.....	
560		.....	.....	15,200	.....	.....	
561		.....	.....	.....	13,560	.....	
562	4 x 4	12,430	.....	.....	.....	.....	
563		.....	16,140	.....	.....	.....	
564		.....	.....	13,950	.....	.....	
565		.....	.....	.....	13,760	.....	
566		.....	.....	.....	.....	12,830	

CONSUL FLEMING of Edinburgh, Scotland, writes that a local wholesale agent, handling largely nuts and bolts, wants to communicate with firms in the United States manufacturing bolts (round and square, counter-sunk heads). This dealer says that the American manufacturers are now pushing the Germans very hard for the trade in bolts and nuts in the United Kingdom. In 1897, bolts and nuts began to come from the United States, and the trade has been increasing rapidly.

TRIPLE DUPLEX AIR COMPRESSOR.

The illustration presents a view of an air compressor built by the Marion Steam Shovel Co., of Marion, O., for its own use. It was completed recently and has given very satisfactory service. It is a triple duplex machine, with cross-compound air cylinder. The compressor is constructed with three substantial engines connected with one engine shaft. Wrist pins are set at 120 degrees; consequently there is no dead center. The air cylinders are connected direct to the engine piston and have water jackets throughout for cooling cylinders. These cylinders are of different sizes, and work compound by bringing the air to the required pressure by two steps. Arrangements are made whereby the air is thoroughly cooled before it is compressed a second time, thus adding greatly to the efficiency of a compressor that brings the air up to the required pressure at one operation. All wearing surfaces are of large diameter and can be reached without any trouble for adjustment. It has all of the advantages of a duplex compressor, as it is arranged so that in case of an accident to any cylinder of the three this cylinder could be cut out in a few moments for repairs, and the others continued in service.



TRIPLE DUPLEX AIR COMPRESSOR.

NATIONAL FOUNDERS' ASSOCIATION.

Reference was made in these columns recently to the work of the National Founders' Association, and particularly to the results of its conference with officers of the Iron Molders' Union, which mean the beginning of a regime of arbritration and of annual wage adjustments for foundries. The strength of the organization and the influential place it has attanied thus early in its career will appear from the list of general and of district officers which we give below:

President, O. P. Letchworth, Pratt & Letchworth Co., Buffalo, N. Y.; vice-president, H. M. Leland, Leland & Faulconer Mfg. Co., Detroit; treasurer, W. H. Wells, Holly Mfg. Co., Lockport, N. Y.; secretary, John A. Penton, Detroit. Administrative Council—O. P. Letchworth, president, Buffalo, N.Y.; W. O. Barbour, Barbour-Stockwell Co., Boston, Mass; Jas. Barclay, Deere & Mansur Co., Moline, Ill.; A. J. Caldwell, Henry R. Worthington, Brooklyn, N. Y.; G. E. Emmons, General Electric Co., Schenectady, N. Y.; I. W. Frank, Frank-Kneeland Machine Co., Pittsburg, Pa.; H. M. Leland, Detroit, Mich.; R. C. McKinney, Niles Tool Works Co., Hamilton, O.; C. L. Newcomb, Deane Steam Pump Co., Holyoke, Mass.; Geo. S. Rominger, Girard Iron Works, Philadelphia, Pa.; Jos. A. Stone, Riverside Foundry Co., Cleveland, O.; Wm. Taylor, Chandler & Taylor Co., Indianapolis, Ind.; W. H Wells, Lockport, N. Y.; W. H. Pfahler (honorary), Philadelphia, Pa.

First District Committee.—Chairman, C. L. Newcomb, Holyoke, Mass.; vice-chairman, W. O. Barbour, Boston, Mass.; G. B. Buckingham, Arcade Malleable Iron Co., Worcester, Mass.; H. A. Carpenter, A. Carpenter & Sons Foundry Co., Providence, R. I.; Walter Perry, Farrel Foundry & Machine Co., Ansonia, Conn.

Second District Committee.—Chairman, A. J. Caldwell, Brooklyn, N. Y.; vice-chairman, G. E. Emmons, Schenectady, N. Y.; Geo. H. Cushing, Goulds Mfg. Co., Seneca Falls, N. Y.; Edward Maher, Maher & Flockhart, Newark, N. J.; John E. Sweet, Straight Line Engine Co., Syracuse, N. Y.

Third District Committee.—Chairman, I. W. Frank, Pittsburg, Pa.; vice-chairman, Geo. S. Rominger, Philadelphia, Pa.; Philip Mathes, Brittan & Mathes Co., Pittsburg, Pa.; Frank Moore, Pittsburg Malleable Iron Co., Pittsburg, Pa; Walter Wood, R. D. Wood & Co., Philadelphia, Pa.

Fourth District Committee.—Chairman, Jos. A. Stone Cleveland, O.; vice-chairman, R. C. McKinney, Niles Tool Works Co., Hamilton, O.; Chas. A. Bauer, Warder, Bushnell & Gessner Co., Springfield, O.; C. H. Booth, Lloyd Booth Co., Youngstown, O.; M. T. Conklin, Gale Mfg. Co, Albion, Mich.

Fifth District Committee.—Chairman, Wm. Taylor, Indianapolis, Ind; vice-chairman, Jas. Barclay, Deere & Mansur Co., Moline, Ill.; Geo. F. Cottrill, Green's Car Wheel Mfg Co., St. Louis, Mo.; L. W. Noyes, Aeromotor Co., Chicago, Ill.; E. H. Walker, J. I. Case Threshing Machine Co., Racine, Wis.

From the engineering department of Milwaukee the statement is given out that the price of water pipe has been advanced $10 by the newly formed American Pipe & Foundry Co. There is reason to doubt the accuracy of the statement. The new consolidation has competition, in the first place, and could scarcely afford to give it such margin. And if all the pipe companies were in the consolidation such an advance would only invite speedy competition from new sources.

The Millett Core Oven Co., of Brightwood, Mass., reports a larger sale of its ovens this year than in any previous year. Several export orders have been received and the company received five cablegrams last month with orders from abroad.

BELT CONVEYING.

The reduction of belt conveying to a scientific method of carrying materials in bulk has been of great interest to those whose work entails the problem of handling coal or ore. Three years ago, we published extracts from a paper on the subject which Mr. Thomas Robins, Jr., read before the American Institute of Mining Engineers. Shortly afterward

FIG. 1.

he incorporated the Robins Conveying Belt Co., for the purpose of carrying out and perfecting the ideas and suggesions contained in his paper, and the belt conveying machinery of this company is now recognized as one of the standard

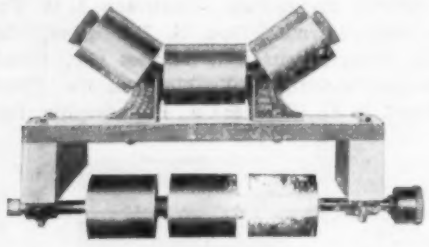


FIG. 2.

methods of handling bulk material. Its parts have been made interchangeable and their capacity and durability and power requirements have been thoroughly tested. The results are indicated by the number of new installations which are being made, and its advocates include all who have used it for any length of time.

Instead of having a multiplicity of parts, this system has but two—the belt and the idlers. The conveying surface is separated absolutely from the highly lubricated running parts, permitting each to perform its function with the highest efficiency. The result is a system which insures a complete freedom from shut-downs; and the recognition of this feature as much as any other thing has led to its adoption so generally in the past two years. The material is carried on the belt without breakage or contact with the running parts, or noise, and is delivered at one or more points in quantities as great as 1,200 tons per hour when desired. Its capacity for handling large amounts of material is the feature that has strongly commended the belt conveyor. The belts can be run at a very considerable angle, although no flights are used. The power requirements are comparatively low owing to lack of friction; and in cases where trestles must be used, the

FIG. 3.

lightest construction suffices, as the load is small but constant.

It was to the belt itself that Mr. Robins first turned his attention and the cross-section cut Fig. 1 shows the design finally adopted as the only one giving satisfaction under all conditions. The reinforcement of rubber at the center, where the load is principally carried, serves to protect it from wear, while the extra plies of duck at the sides render them stiffer and cause the belt to conform readily to the troughed shape of the idlers.

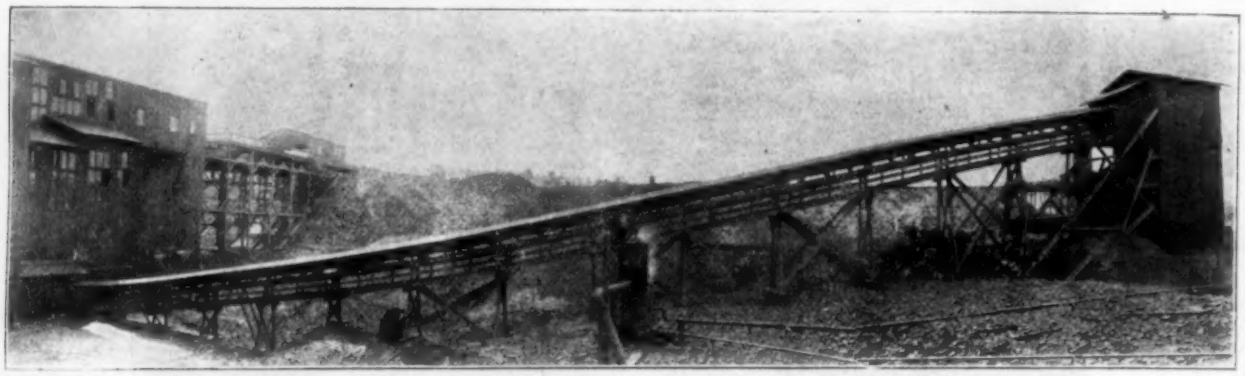


FIG. 4.

After experiments with spool and cone pulleys and with two inclined pulleys, the three-pulley arrangement shown in Fig. 2 was selected as the standard idler, on account of its manifest advantages. This, together with the belt and the other parts of the system, is protected by United States and foreign patents. The idlers need but little explanation save

FIG. 5.

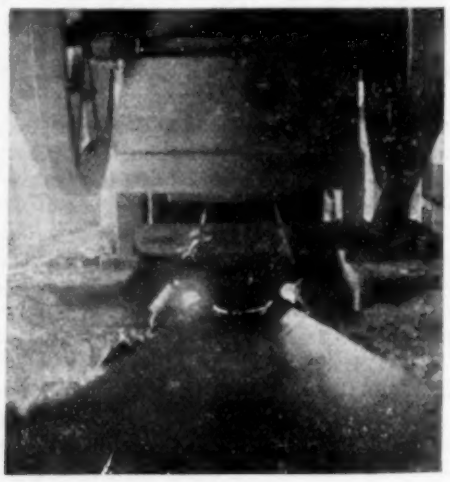


FIG. 6.

that in the process of lubrication through the hollow shafting by the grease cups, all bearings are rendered entirely dust-proof.

The four cuts of the belt in operation illustrate some of the various uses to which the system is adapted. Fig. 3 shows the belt in use on a dredger-arm carrying the rocks and gravel blasted from the bottom of the Danube to its banks. With a capacity of 1,100 tons per hour and carrying many pieces 250 lbs. in weight, with an occasional rock of 500 lbs., this conveyor is an example of the hard service which may be expected of the system when properly operated.

Fig. 4 is from a photograph taken at the No. 6 breaker of the Pennsylvania Coal Co., at Pittston, Pa., and shows a long conveyor running under the screens and carrying off the slate and waste to the culm pile. The belt conveyor has been used extensively in the last year for carrying off waste from coal breakers and washeries and tailings and refuse from mining and refining plants. In this connection, its ability to elevate and to deliver at any point along its length has been of great advantage, as it has been also in the handling of coal in pockets, power houses and storage piles.

Fig. 5 shows the substitution of the belt for a picking table at the War Eagle mine in Rossland, B. C. When used in this way, the belt is specially designed and two level pulleys instead of one are used in the troughing idler, giving a broad, flat belt surface, slightly turned up at the edges. A number of these picking belts are in use and are giving great satisfaction.

Fig. 6 illustrates a belt conveying running under the new limestone crusher of the New Jersey Zinc Co., at Franklin Furnace, N. J., and this is another use for which the system is well fitted. The stone is carried as fast as crushed to large bins whence it is loaded directly on the cars for shipment. The new catalogue of the Robins Conveying Belt Co. has many photographs of the system in use in various capacities and it may be had on application to the office of the company, 147 Cedar st., New York.

THE American Steel & Wire Co., which recently purchased five large vessels of the Zenith Transit Co. fleet, is negotiating for two steel tow barges, to be built by the Chicago Shipbuilding Co. for delivery in 1900. The steamers which have heretofore carried Cleveland Rolling Mill Co. ore—the Wm. Chisholm, J. H. Wade, Samuel Mitchell, and J. H. Devereux—were not taken over in the purchase of the Cleveland Rolling Mill property, never having belonged to that company. They are still independent boats, though there is a possibility of their being taken by the American Steel & Wire Co.

IT is stated that there is urgent need in the City of Mexico for more foundries and machine shops capable of doing first class work promptly. With the large number of improvements under way there and the number of establishments the city now has, with machinery often in charge of inexperienced men, the supply and repair business is large and prompt filling of orders is almost unknown.

The Virginia Iron, Coal & Railway Co. is reported to have purchased the plant of the Watts Steel & Iron Syndicate, Ltd., Middlesborough, Ky., with the intention of putting in blast the steel plant and furnaces at full capacity. The purchase includes control of other coal and iron properties.

A MEETING of the manufacturers of shafting was held at Pittsburg last week, and it was decided to make an advance in prices, averaging about 10 per cent, in view of the increased cost of raw materials.

A HARTFORD, Conn., dispatch says that the proposed bicycle consolidation may not succeed, in view of the unwillingness of Col. Pope to put in the motor carriage department of his company.

A FLEMINGTON, N. J., dispatch says that after being idle for several years the Butsville iron ore mines will resume operations. The mines have a daily output of 300 tons.

LUBRICATION OF GEARING.

The lubrication of the teeth of gearing is a subject of greater importance than it is ordinarily considered, and well worth investigation. The idea that waste lubricants from bearings, engines, and machinery generally are good enough to apply to gear teeth, is doubtless based on the belief that gearing must wear by reason of frictional contact in transmission of power, and that its life is dependent solely upon how well it is proportioned for its work; and more especially where failure occurs through wear, to the working pressure per inch of bearing surface provided in its construction, without regard to lubrication. There is a vast difference between the lubrication of a bearing for a revolving journal, and that of gear teeth, in which even the rolling effect at pitch line may be lost through inaccuracies of ordinarily constructed gear teeth, and partake of sliding frictional contact, incident to engagement at other points than the pitch line in carefully prepared gearing. Gear teeth are constructed to have as little side clearance between the teeth when engaged, as is consistent with the method of production.

Perfect working gear teeth would be those without side clearance, and approximated only in cut gearing of finest pitch, while ordinary commercial cut gearing have from 1-64 inch to 1-16 inch, and gearing with cast teeth from 1-16 inch to ⅛-inch initial side clearance approximately for various pitches. The shock from irregular loads is imparted to the sides opposite the regular bearing surfaces of teeth, in hammer-blows of strength proportioned to varying loads and distance of travel in side clearance (commonly termed back-lash) before requiring reverse contact. This alternate action on opposite sides of the teeth, tending to crystallization and breakage, is suggestive of the method adopted by a blacksmith to break a bar of iron, when, after nicking, he subjects it to sledge blows alternately from opposite sides. Since the side clearance exists only from necessity and practical reasons assigned, the retarding of wear and its consequent increase of side clearance, is essentially important in lessening the ill effects of back-lash. Gear teeth having an initial side clearance of 1-64 inch, will by wear of only 1-64 inch each on contacting teeth produce a side clearance of 3-64 inch or an increase of 200 per cent, and thus contribute a greatly intensified shock to hasten destruction.

The successful lubrication of journal bearings depends upon the ability of the lubricant to reach and enter restricted spaces, as well as freedom from tendency to form a built-up deposit. Thus petroleum products are well adapted to such lubrication. It is equally evident from the action of gearing described, that a lubricant to answer satisfactorily its varying requirements must possess tenacious qualities to adhere and build a deposit on the working surfaces of teeth, thus preventing metallic contact and consequent wear and noise. A like deposit on the opposite sides of the teeth reduces side clearance and forms a cushion for back-lash, greatly decreasing noise and destructive action.

The accompanying illustration shows in the heavy lines on the sides of the teeth the effects of application of a material known as gear shield with which the above described results are attained. Its efficacy appears in the longer life and decreased noise of gearing on which it has been used, in widely varying lines, from fast running motor gearing on street cars, to the most ponderous and heavily dutied gearing of rolling mills. Its efficiency in avoidance of expensive replacings has also been demonstrated on many gears not in themselves under severe duty, but subjected to detrimental influences such as dusty, gritty, or other flinty atmospheric conditions favorable to rapid wear. This gear shield is manufactured by the Ironsides Co., Columbus, O.

A PHILADELPHIA dispatch says that the order for 80,000 tons of steel rails for the Siberian railroad has been placed again with the Pennsylvania Steel Co. and Maryland Steel Co. at close to $24 a ton. The same interests took the order four months ago at $18 a ton, but some unlooked for complications arising, the Russian government canceled it. It is now ready to proceed with the work, and has placed a contract again, paying about $400,000 more than the original price.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants :—

The Muncie Foundry & Machine Co., Muncie, Ind., capital $25,000, has been incorporated. Directors: A. F. Patterson, G. F. McCulloch, W. M. Patterson, W. C. Denney and W. C. Sampson.

Walter Tips, of Bachman Foundry & Machine Co., Austin, Tex., will purchase shaper, drill, punch, shear, etc.

Preparations are being made to put in operation the Columbia Barb Wire & Nail Works, Kanawha City, W. Va., capacity of 100 tons per day. D. A. Chenowith, of Indianapolis, Ind., is manager.

J. F. Hanning Co., Cloverport, Ky., is in the market for boiler and engine.

Harby & Co., Sumter, S. C., ask prices on machinery for straightening and punching cotton ties.

The Birmingham Boiler Works, Birmingham, Ala., is in the market for one second-hand punch capable of punching a seven-eighths inch hole in seven-eighths inch thick iron; an air compressor and a punch to make a three-quarter inch hole in iron three-quarter inch thick.

A manufacturing concern in the Central West is considering a change of location. It manufactures shovels, spades, scoops, railroad supplies and pressed steel specialties, operating the year round and employing from 150 to 350 hands. It prefers to find a plant ready for occupancy, a building of brick or stone, one story, about 80x400 ft., equipped with engine and boiler, about 175 h. p., line shafting, etc.

The Cincinnati Street Railway Co will open car shops at Chester Park and build its own cars. As additional room is needed, new buildings will go up on the ground now occupied by Chester Park.

New Construction :—

The Peru (Ind.) Land & Improvement Co. has advices from Chicago capitalists accepting an offer of $23,000 cash, a 10-acre tract and $20,000 in lots, for the location of a steel plant.

The Niles Boiler Co., Niles, O., has nearly completed its foundry and fitting shop. A pattern shop is also to be built.

S. B Sexton & Son, 511 West Conway st., Baltimore, will erect a four-story brick building to their stove and iron foundry.

The Lorain Steel Co.'s improvements at the steel plant at Lorain, O., are nearing completion and the blooming mill engine will be ready to turn over in the course of a week. The object is to roll for the shape mill directly from the ingot without reheating. The finishing capacity of the mill is doubled, and the frames of the necessary additions are up. The new mixer building is well along.

The enlargement of machine shops of the L. & N. R. R. at New Decatur, Ala., previously referred to, will consist of additions to the boiler, blacksmith and car shops and the planing mill. $20,000 of new machinery will be installed.

W. F. Rocho is building a boiler shop at Boone, Ia.

The Dallenbaugh Gas Engine Co., it is stated, will build at Ellwood City, Pa., a plant for the manufacture of gas engines.

At the Bath Iron Works, Bath, Me., the new machine shop is nearing completion. A 20-ton and a 5-ton crane have been installed, in addition to a number of new tools.

At Indianapolis, Ind., Nordyke & Marmon, machinists and engine builders, are making additions that will add 75,000 square feet of floor space. There will be one addition two stories, 243x60 feet, another two stories, 75x50 feet, and a third of one story 252x60 feet. An extra story is also to be added to one of the present buildings, 175x48 feet. Two of the new buildings are about completed, and work on the third is beginning. In addition to these the firm will erect a two-story brick storage building 80x100 feet.

It is understood the National Steel Co. will begin shortly on the work of greatly enlarging the Buhl mill at Sharon, Pa.

Fires and Accidents:—

Fire on April 9 destroyed the Northern Pacific machine, boiler and blacksmith shops at Mandan, N. D. The loss is $50,000 to $75,000.

At Montreal, Que., the Dominion Metal Works of Garth & Co., were burned with $60,000 loss.

Fire in Cambridge, Mass., April 7, did $75,000 damage. The loss of the Riverside Boiler Works is about total. The Bay State Metal Works, loss partial, has $20,000 insurance.

Power Equipment and Machine Tools.

The Niles Tool Works have just received from France an initial order for large boring and turning machine tools for engine works near Paris. Three large gun lathes have recently been shipped to St. Petersburg for the Russian government. The value of the two orders is about $100,000.

A. Frankevitch, chief engineer of the Russian navy, and George B. Hartley, superintendent of the boiler department of the Cramps, of Philadelphia, who are now building the battleship Retvezan and the cruiser Variag for the Russian navy, have been at Barberton, O., and Chicago, recently, to inspect the work done by the Stirling Co., which has the contract for furnishing the boilers for the cruiser, and that of the Illinois Steel Co., which is to furnish the plates for the boilers. The boilers are to be of the Niclausse water tube type, and they are expected to develop power for a speed of 23 knots an hour.

The Turner Engineering Co., of Bucyrus, O., is furnishing the Turner watertube boiler, 250 h. p. for the Findlay, O., street railway; two of 200 h. p. for the Central Traction Co.; three of 225 h. p. for the Indianapolis Ice & Cold Storage Co. Large boilers of this type, recently put into service are showing good results.

Henry R. Worthington, New York, has the contract for the entire equipment of pumping machinery for furnishing the water supply for the Paris Exposition in 1900. The pumping plant will consist of four Worthington horizontal high-duty triple-expansion condensing engines, 12 and 20 and 34x26x24, having a total capacity of 44,000,000 gallons in 24 hours, against a total head of 37 lbs., with 150 lbs. steam. The engines will be of the most approved Worthington type, each supplied with a surface condenser in the suction and attached air pump.

Though export trade has been a prominent feature of their business for several years, Cincinnati machine tool manufacturers now point to the home trade as a strong factor in the present excellent demand, contributing, in fact, the greater part of the improvement of the past few months. The American Tool Co. has received an order for $20,000 worth of iron working machinery from Japan and an English order amounting to $25,000.

The Ohio Steel Co., at Youngstown, O., is putting in three large pumps with a capacity of 18,000,000 gallons of water.

At Sterling, Ill., a battery of boilers and an 800 h. p. engine are to be installed at the Dillon-Griswold wire mill. The engine will be put in a new 40x60 building.

The Pittsburg District:—

The rod mill of the American Steel & Wire Co., Beaver Falls, Pa., broke its 12 hour record by 15,000 lbs. on March 25, turning out 436,000 pounds.

Thirteen carloads of steel plate and structural shapes were shipped from the lower Allegheny plant of the Riter-Conley Mfg. Co. last week for the Johannesburg gold fields. This shipment comprised material for a number of tanks to be used in the South African region in the cyanide process of gold mining. The shipment aggregated 500 tons in weight.

The Riter-Conley Co., of Pittsburg, is erecting a new steel building over the gas furnaces at the American Steel Casting Co.'s plant, at Sharon, Pa.

The Pittsburg Steel Casting Co., recently formed, has changed its name to the Union Steel Casting Co. The capital will be $75,000. Two buildings will be erected for the company by the Shiffler Bridge Co.

The new airbrake works now being built at St. Petersburg, Russia, by the Westinghouse Airbrake Co., is rapidly nearing completion. Men have been sent to start them in operation.

Engineers have staked out the ground for the new tube plant at Beaver Falls, Pa. Work will begin shortly.

The Shiffler Bridge Co., of Pittsburg, has more work on its books than ever. It has just received a contract for the erection of large ore bins for the National Steel Co., at the new blast furnaces at Youngstown, O.; also a contract for ex-

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tending a steel pier of the Atlantic City Steel Pier Co.; another for the structural work for an extension to the punch shop of the Westinghouse Electric & Mfg. Co., at East Pittsburg. It is the intention of the company to begin work soon on the new plant at Homestead planned some months ago.

Heyl & Patterson, of Pittsburg, have been awarded a contract to erect a car hoist for the East Goshen (O.) Coal Co. It is to be able to haul four cars a minute.

The contracts for the power plant for the new Union Steel Casting Co., which is to be erected on land recently secured near the Sharpsburg bridge, have been awarded to the Westinghouse Machine Co., and Westinghouse, Church, Kerr & Co. The installation will include a gas engine of 50 h. p.

The United States Circuit Court made an order in the case of the Vega Iron Co. against the Pittsburg Steel & Iron Co., directing the receiver to offer for sale on May 10, 1899, the real estate, plant and works subject to the lease made by the receiver to William P. Snyder and Laughlin & Co., Ltd, and also subject to the lien of the purchase money mortgage of the New York Life Insurance Co. The property is the old Soho Furnace. The lease to Wm. P. Snyder and Laughlin & Co., Lt., expires July 1, 1899. The balance due on the mortgage is $327,500.

The Pittsburg Locomotive Works have received from the Chambersburg Engineering Co., Chambersburg, Pa., the largest hydraulic riveter yet built. It is of 186-inch gap, with three pressures of 40, 85 and 125 pounds. It weighed 100,000 pounds without attachments. Some of the heavy steel castings for this riveter were made by the Otis Steel Co., of Cleveland.

The Westinghouse Machine Co., Pittsburg, is well along in the general plans being prepared for the manufacture of blowing and rolling mill engines. The designs will embody some exclusive features. It will be some time yet before the company is prepared to enter the market for this class of work, but when it does, a full line of engines for rolling mill work, steel plants, and blast furnaces, will be manufactured.

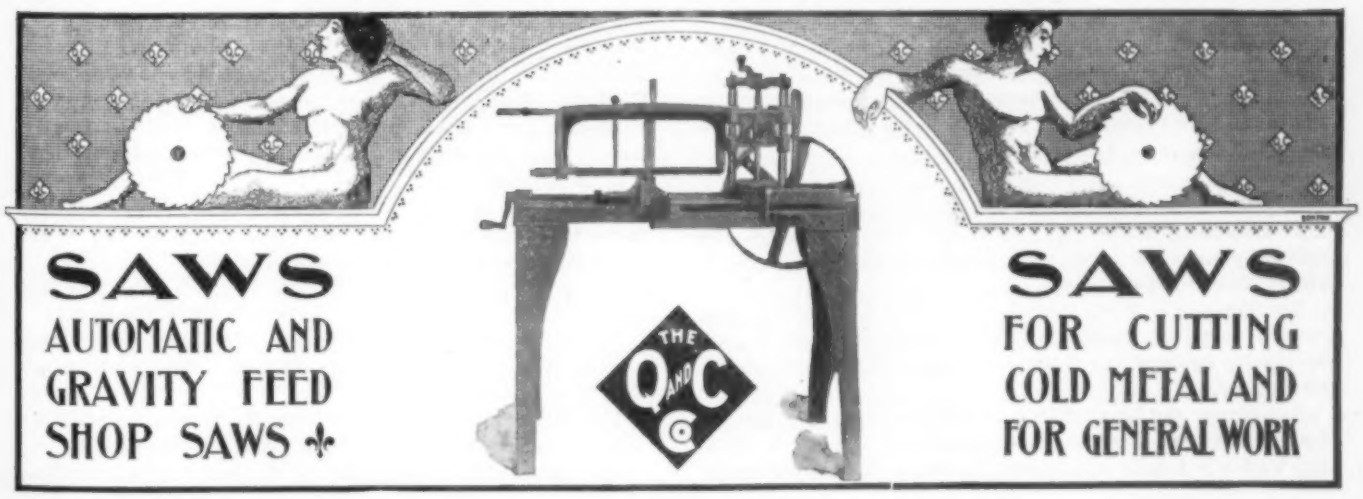
The West Penn Sheet Steel Co., Leechburg, Pa., operating the sheet mill formerly belonging to Jennings Bros. & Co., has received an order for 50 tons of heavy gauge steel sheets, which are to be shipped to New York and there manufactured into coal baskets for the use of Dewey's fleet at Manila. The company three weeks ago filled a 35-ton order for this material which was shipped to the Philippines, being the first shipment of American steel to the islands since the beginning of hostilities.

The Braddock, Pa., parties already mentioned have just purchased 10 acres of land at Rankin Station, and have broken ground for the erection of a wire nail plant. It is stated that the capital of the company which is being organized will be $100,000.

The new owners of the Old Meadow Rolling Mill, the sheet plant recently erected at Scottdale, Pa., have signed the Amalgamated scale and put the plant in operation. I. W. Frank, of the Frank-Kneeland Machine Co., who built the mill, is one of the owners. The mill was idle for some time owing to the fact that a number of stockholders in the original company, who were union men, objected to the company's endeavoring to run the mill non-union.

The Pressed Steel Car Co., Pittsburg, has let the contract for excavating for the foundation piers, trenching and sewers of its proposed plant at McKees Rocks, Pa., to A. Winters & Son, Allegheny, and work is to begin in a few days.

The Riter & Conley Mfg. Co., Pittsburg, has just received



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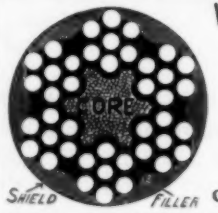

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a contract for constructing a mile of steel pipe to be used in mining in Colorado. The pipe will be 24 and 36 inches in diameter, and will be riveted in 30-foot lengths for shipment.

The plant of the Canonsburg Iron & Steel Co., Pittsburg, which is located at Canonsburg, Pa., has resumed work in full in all departments, after the shut down pending its transfer to the American Tin Plate Co.

General Industrial Notes:—

The Glamorgan Pipe & Foundry Co., Lynchburg, Va., has sold its plant to a New York syndicate headed by M. J. Drummond, 192 Broadway.

The Portage Iron Co.'s nail plant at Duncansville, Pa., recently acquired by the American Steel & Wire Co., has suspended operations. A number of nail workers will return to Findlay, O.

Among car and locomotive contracts and inquiries reported by the *Railroad Gazette* are the following: Columbus Hocking Valley & Toledo 10 engines; Boston & Maine, six freight and six switching engines; D. L. & W. 20 12-wheel freight engines; Toledo & Ohio Central, 500 box cars; Raleigh & Western, 300 freight cars; St. Paul & Duluth, 300 box cars; Chicago & Northwestern, several hundred soon to be ordered; C. M. & St. Paul, to build 5,000 cars at West Milwaukee against 3,000 last year; Louisville, Henderson & St. Louis, 1,000 freight cars; Pennsylvania Railroad, 510 box cars; C. H. V. & T., 2,000 coal cars.

The Gillette-Herzog Co., of Milwaukee, has leased the malleable iron plant of the Wood Harvester Co. in St. Paul. The company plans a large extension of business.

The Jenifer Furnace at Jenifer, Ala., will soon go into operation. A 500-ton washer will be erected at the mines.

Two thousand iron ore miners in Bibb County, Ala., have gone on strike. The cause is said to be a complaint against the check system.

The Foster Stove Co. at Ironton, O., is idle because of a disagreement between the company and the molders.

The Penn Steel Casting Co., at Chester, Pa., will increase

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The Niles Fire Brick Co., Niles, O., is working up to full capacity and the large demand is keeping stocks on hand at the low point. At present the company is manufacturing one high grade of hand-made bricks and is fast coming to the point where enlargement of the plant will be necessary to supply increasing trade. A silica fire brick department is about to be added to the works.

A movement is on foot to consolidate the blast furnace plants and mineral properties of the Sheffield district in Alabama.

The Catoctin Furnace at Catoctin, Md., will resume operations soon.

Philadelphia and Roanoke capitalists have purchased the Radford Pipe & Foundry Co.'s plant at Radford, Va., idle for some time. The plant originally cost $500,000. It has a capacity of 125 tons a day.

It is reported that the Detroit Steel & Spring Co.'s plant will be included in the car supply consolidation which is being promoted by Chas. L. Freer.

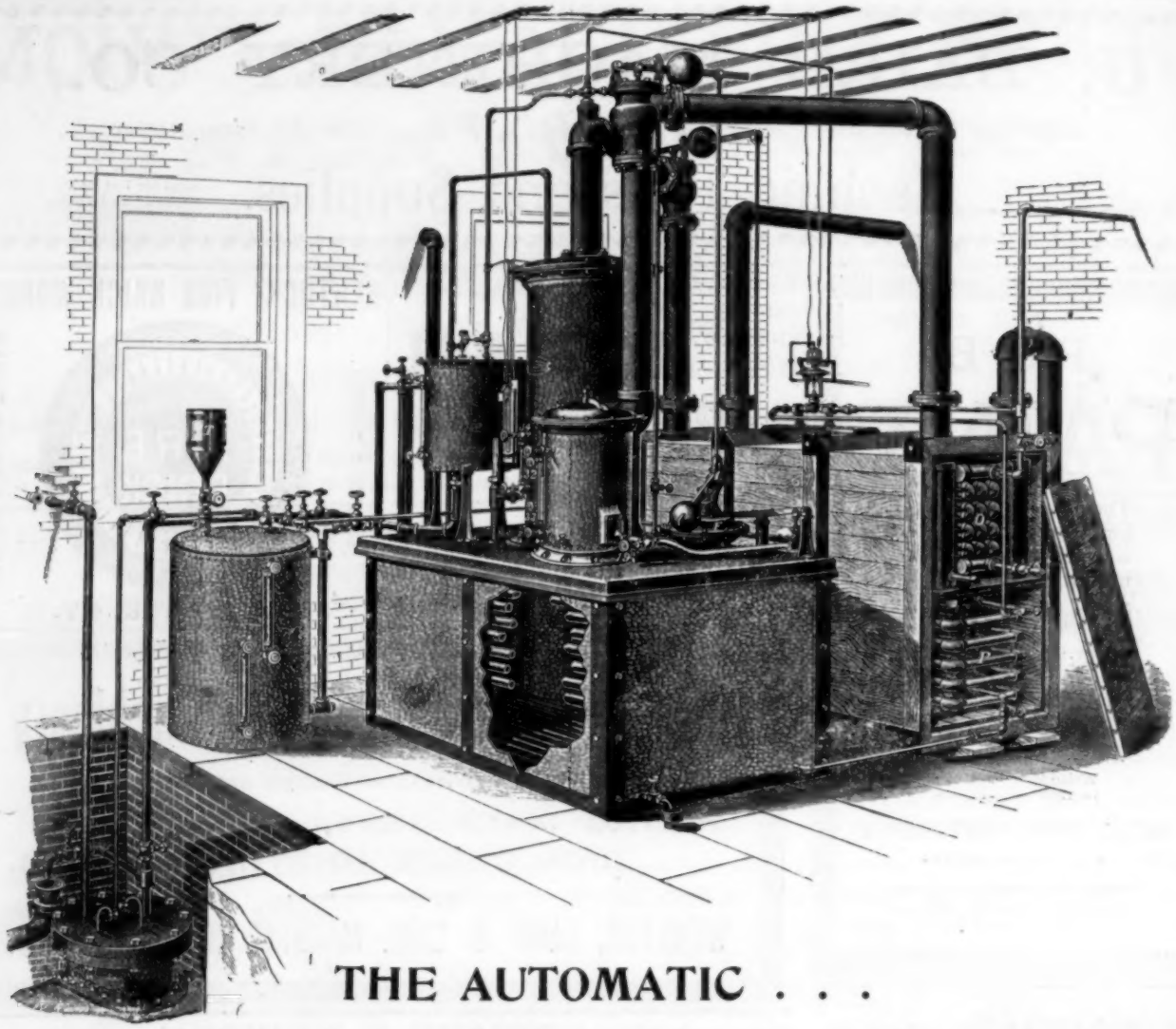
The Chicago Terminal Transfer Railroad Co. is seeking entrance to Chicago Heights, Ill., in view of the location of several large manufacturing plants there in the past year. Chicago Heights is now one of the most prominent manufacturing points in the Chicago district.

The March records of the Joliet works of the Illinois Steel Co. were exceptional. The converting mill produced 50,500 tons of steel, which was 2,000 tons above the record. The billet mill made 42,400 tons, an average of 793 tons each turn. The best previous record was 40,621 tons, made in January. In the rod mill the total was 16,240 tons, an average of 312 tons to the turn. The January record, the best previous one, was 15,600 tons.

It is said that Horace L. Chapman will rebuild the Tropic Furnace, on the Ohio Southern Railroad, between Wellston and Jackson, O. It had a capacity of 80 tons per day.

The Bethlehem Iron Co. statement recently made in view of the financing of the Bethlehem Steel Co., shows that the earnings in the past five years have averaged over $1,300,000 net per annum, which, after allowing for the guaranteed dividend of 6 per cent on the $7,500,000 Bethlehem Iron stock, amounting to $450,000, shows 5½ per cent on the $15,000,000 proposed new steel stock. For the current fiscal year which ends May 31, next, the earnings have been on a basis that shows over 8 per cent on the new steel stock. In the previous fiscal year the company paid 8 per cent on $5,000,000 and carried 13 per cent to the credit of profit and loss.

Pine Grove Furnace, of Mears, Kyle & Co., at Hanging Rock, O., is being torn down. It blew out in 1895. The stack was 34 x 11 feet. It was built in 1827 and rebuilt in 1844, being active over a period of 68 years.



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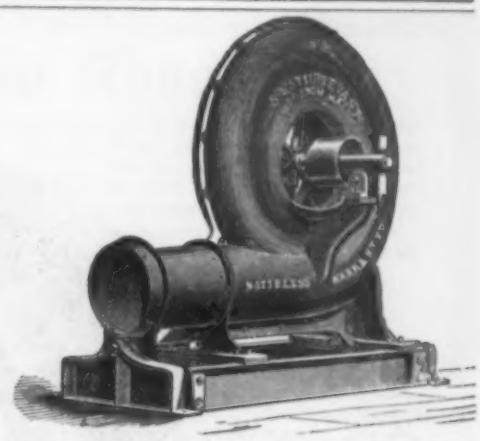

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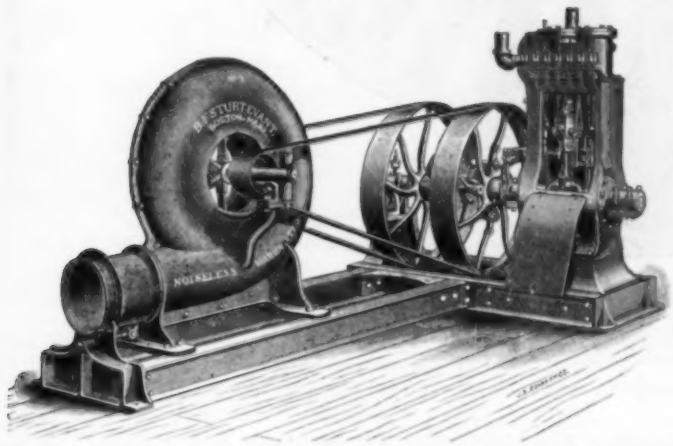

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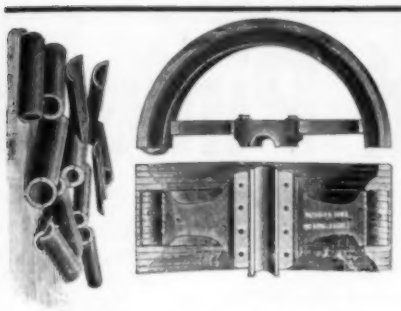

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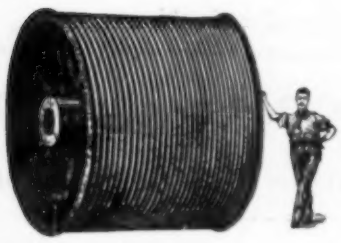

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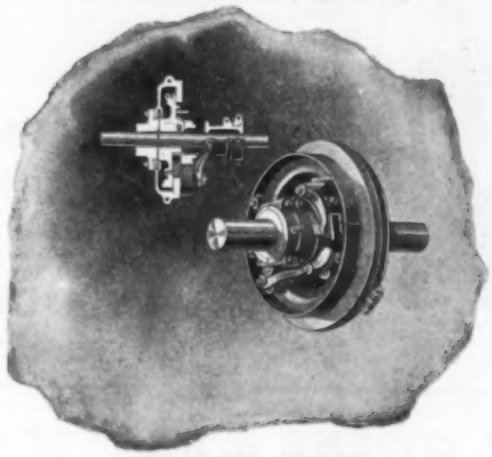

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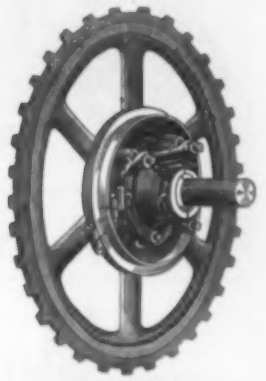

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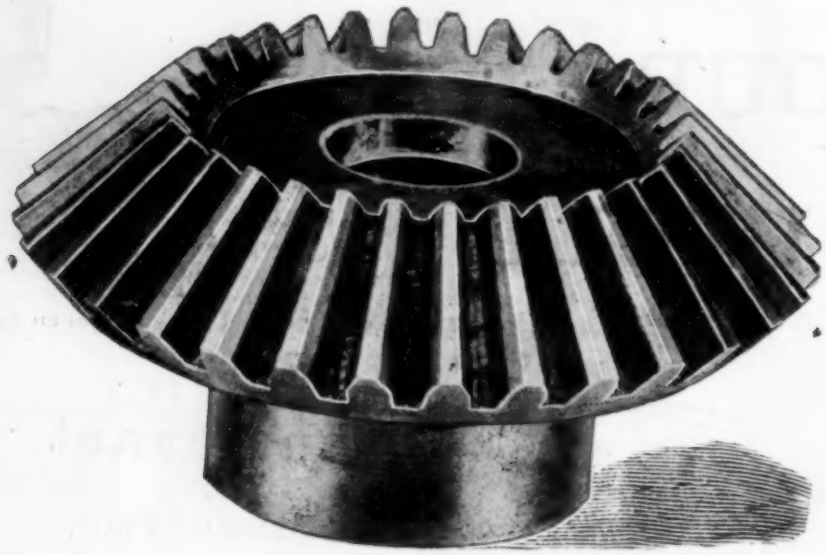

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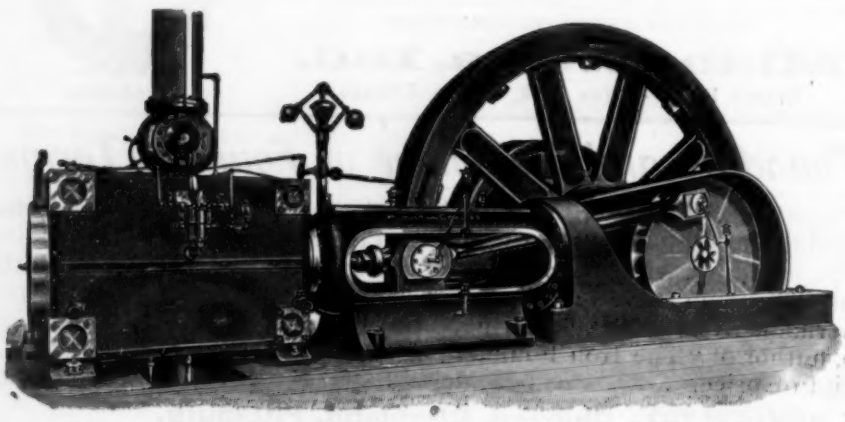

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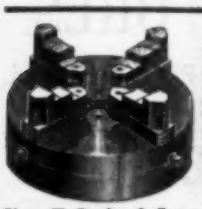

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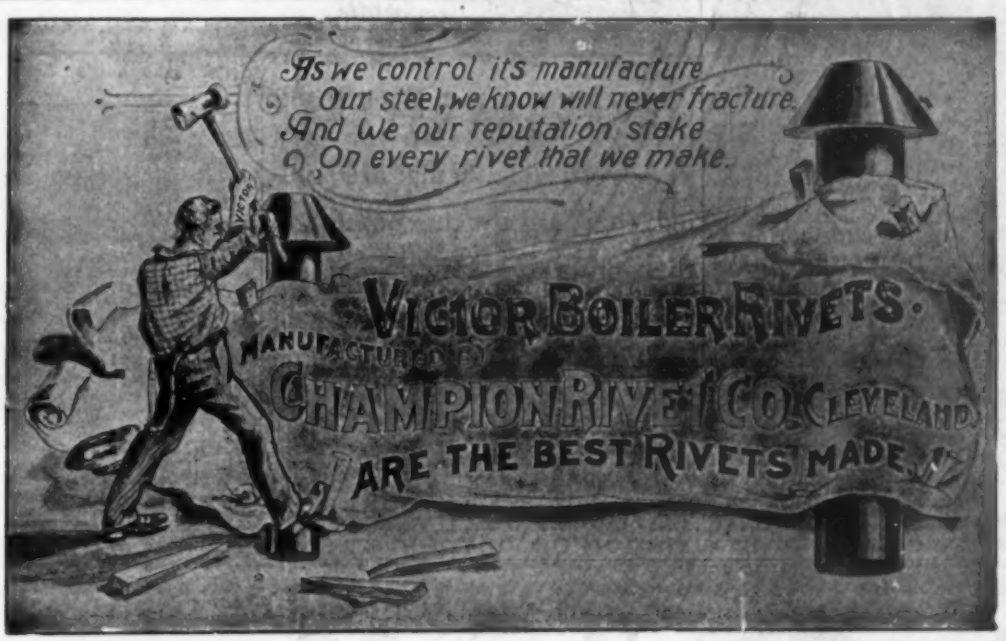
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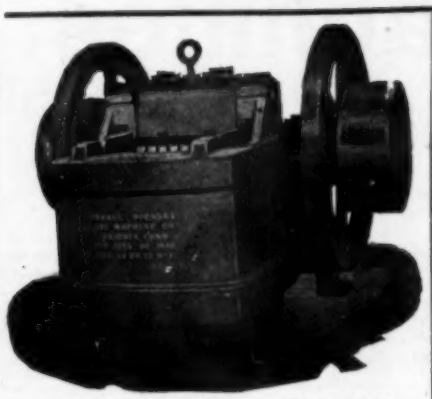

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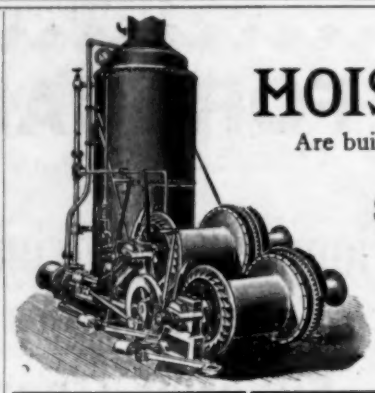

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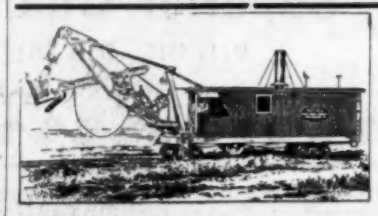

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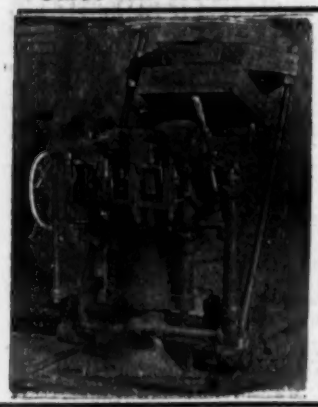

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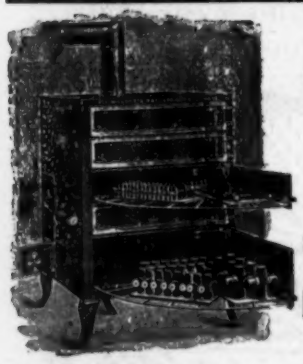

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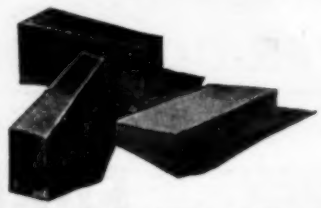

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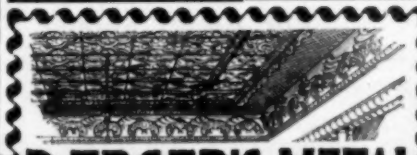

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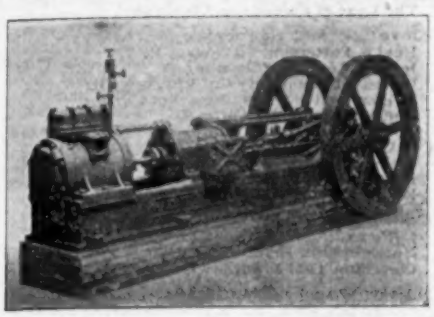

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Berger Mfg. Co., Canton, O.

Elevators—
The Lane & Bodley Co., Cincinnati, O.

Elevating and Conveying Machinery—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
Detroit Sprocket Chain Co., Detroit, Mich.
Robins Conveying Belt Co., New York City.

Emery and Corundum Wheels—
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland, O.

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland, O.

Engineers and Contractors—
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville Ohio.
E. E. Erickson, Pittsburg, Pa.
Benedict Crowell, Cleveland, O.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.

Engine Packing—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.

Engineers' Supplies—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Engine Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington & Son Co., Philadelphia

Engines (Oil)—
The Aultman Co., Canton, O.

Engines (Steam)—
Wm. Tod & Co., Youngstown, O.
B. F. Sturtevant Co., Boston, Mass.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.
I. & E. Greenwald Co., Cincinnati, O.
Webster Camp & Lane Machine Co., Akron, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Fraser & Chalmers, Chicago, Ill.

Engravers and Electrotypers—
Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.
Eclipse Electrotype & Eng. Co., Cleveland, O.

Exhaust Heating Apparatus—
B. F. Sturtevant Co., Boston, Mass.

Fans—
American Gas Furnace Co., New York City.
B. F. Sturtevant Co., Boston, Mass.

Feed Water Heaters and Purifiers—
Stilwell-Bierce & Smith-Valle Co., Dayton, O.
Harrison Safety Boiler Works, Philadelphia, Pa.

Files, Makers of—
C. H. Besly & Co., Chicago, Ill.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield,
Dover Fire Brick Co., Cleveland. Pa.
F. B. Stevens, Detroit, Mich.
The S. Obermayer Co., Cincinnati, O.
Chicago Fire Clay Product Co., Chicago, Ill.
Columbia Fire Clay Co., Cleveland, O.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.

Fire Proof Covering—
C. H. Besly & Co., Chicago, Ill.

Flexible Shafts—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Foot and Power Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa.
Foundries—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & R. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Foundry Equipments—
The S. Obermayer Co., Cincinnati, O.
Foundry Supplies—
Clearfield Fire Brick Co., Clearfield, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland, O.
The S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Columbia Fire Clay Co., Cleveland, O.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
Foundry Facings—
The S. Obermayer Co., Cincinnati, O.
Cleveland Facing Mill Co., Cleveland, O.
Forgings—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Iron Co., South Bethlehem, Pa.
Bræburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Friction Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Furnaces—
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.
Furnace Linings—
Union Mining Co., Mt. Savage, Md.
Fuel Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas Furnace Co., New York City.
Galvanized Iron—
Apollo Iron & Steel Co., Pittsburg, Pa.
Galvanizers—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Apollo Iron & Steel Co., Pittsburg, Pa.
Galvanizing Pots—
The Wm. B. Pollock Co., Youngstown, O.
Gas Burners—
American Gas Furnace Co., New York City.
Gas Furnaces—
American Gas Furnace Co., New York City.
Gearing.
I. & R. Greenwald Co., Cincinnati, O.
Gear Cutting—
The R. D. Nuttall Co., Allegheny, Pa.
Brainard Milling Machine Co., Hyde Park, Mass.
The Van Dorn & Dutton Co., Cleveland, O.
Gear Cutters—
Brainard Milling Machine Co., Hyde Park, Mass.
Gear Lubricants—
The Ironsides Company, Columbus, O.
Grindstones—
C. H. Besly & Co., Chicago, Ill.
Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.,
Grate Bars—
Geo. B. Sennett Co., Youngstown, Ohio.
Gray Iron Castings—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
Brass Founders' Supply Co., Newark, N. J.
Hack Saws—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.
Hangers—
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.
Harness Snaps—
Covert Mfg. Co., West Troy, N. Y.
Hoists—
Edwin Harrington Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.
Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayton O.
Heating and Ventilating Apparatus
B. F. Sturtevant Co., Boston.
Heavy Hardware—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
Hoisting Engines—
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Hoisting Machinery—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
Earl C. Bacon, New York City.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Horse Shoes—
Phoenix Horse Shoe Co., Joliett, Ill.
Hotels—
United States Hotel Co., Cleveland, O.
Hydraulic Machinery—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Injectors—
C. H. Besly & Co., Chicago, Ill.
Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.
Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.
Riter-Conely Co., Pittsburg, Pa.
Iron Nails and steel—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
Iron and Steel Roofing—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Iron Ore—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Barton & Co., Cleveland, O.
Iron Working Tools—
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
The F. B. Shuster Co., New Haven, Conn.
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Brainard Milling Machine Co., Hyde Park, Mass.
Baush & Harris Machine Tool Co., Springfield, Mass.
Massey Vise Co., Chicago, Ill.
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The Jeffrey Mfg. Co., Columbus, O.
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Ladles—
The S. Obermayer Co., Cincinnati, O.
Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington, Son & Co., Philadelphia.
Bickford Drill & Tool Co., Cincinnati, O.
Machinery Name Plates—
August Becker, Boston, Mass.
Machinists' Tools and Supplies—
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Edwin Harrington Son & Co., Philadelphia, Pa.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Massey Vise Co., Chicago, Ill.
Machinists' Vises—
Massey Vise Co., Chicago, Ill.
Machine Screws—
C. H. Besly & Co., Chicago, Ill.
Machine Shops—
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co., Cincinnati, O.
Machinery and Tool Steel—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.
Manufacturing Chemists.
We Fu Go Co., Cincinnati, O.
Manufactured Iron & Steel—
Bourne-Fuller & Co., Cleveland, O.
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Metal Bearings—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Swarts Refining Co., Chicago, Ills.
Milling Machines—
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Brainard Milling Machine Co., Hyde Park, Mass.
Mining Machinery—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Molding Machines—
Tabor Mfg. Co., Elisabeth, N. J.
Mine Pumps—
Fred M. Prescott Steam Pump Co., Milwaukee, Wis.
Molding Sand—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
Molders' Tools—
The S. Obermayer Co., Cincinnati, O.
Name Plates—
August Becker, Boston, Mass.
Nickel Plating Outfits—
Northampton Emery Wheel Co., Chicago, Ill.
Nuts and Bolts
Rockford Bolt Works, Rockford, Ill.
Upson Nut Co., Cleveland, O.
Oilless Bearings—
North American Metaline Co., Long Island City, N. Y.
C. H. Besly & Co., Chicago, Ill.
Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas Furnace Co., New York City.
Oil Cups—
C. H. Besly & Co., Chicago, Ill.
Oil Pumps—
C. H. Besly & Co., Chicago, Ill.
Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Ore Screens—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
The Aultman Co., Canton, O.
Packing—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Paint—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York, City.
Pattern Makers' Vises—
Massey Vise Co., Chicago, Ill.
Pattern Works—
Gobeille Pattern Co., Cleveland, O.
Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Pig Iron—
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
R. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Hickman & Williams, Chicago, Ill.
Spearman Iron Co., Sharpsville, Pa.
Salisbury Carbonate Iron Co., New York City.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pipe Covering—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Pipe Cutting and Threading Machines—
The Armstrong Mfg. Co., Bridgeport, Conn.
Planers—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Planer Chucks—
Massey Vise Co., Chicago, Ill.
Plates—
Enterprise Boiler Co., Youngstown, O.
Plumbago—
The S. Obermayer Co., Cincinnati, O.
Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.
Pneumatic Appliances—
Clayton Air Compressor Works, New York.
Pneumatic Tools.—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago. Ill.
Portable Forge—
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.
Power Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.
Power Presses—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
R. Konigslow & Bro. Cleveland, O.
Power Transmission Machinery—
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago. Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.
Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
R. Konigslow & Bro. Cleveland, O.
Pressure Gauges—
The Bristol Co., Waterbury, Conn.
Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.
Pumps (Steam)—
The Edward P. Allis Co., Milwaukee, Wis.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.

Punches—
E. Konigslow & Bro. Cleveland, O.

Pyrometers—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland, O.

Rivets—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.

Riveted Steel Pipe—
The Wm. B. Pollock Co. Youngstown, O.

Rock Drills—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

Rolling Mill Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Roofs—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.

Sand and Chill Rolls—
Seaman, Sleeth Co., Pittsburg, Pa.

Saws—
Peter Gerlach & Co., Cleveland, O.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

Screws—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill
Rockford Bolt Works, Rockford, Ill.

Shafting—
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

Shapers—
Baush & Harris Machine Tool Co., Springfield, Mass.

Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.

Ship Yards—
Wm. Cramp & Sons, Philadelphia, Pa.

Special Machinery—
Edwin Harrington Son & Co., Philadelphia.
Q & C Co., Chicago, Ill.
A. H. Nilson Machine Co., Bridgeport, Conn
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.

Stand Pipes—
The Wm. B. Pollock Co., Youngstown, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill.

Steam Packing—
C. H. Besly & Co., Chicago, Ill.

Steam Pumps—
Hall Steam Pump Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vail Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.

Steam Shovels and Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

Steam Specialties—
C. H. Besly & Co., Chicago, Ill.

Steel—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.

Steel Castings—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.

Steel Plants—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

Steel Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Ohio Steel Co., Youngstown, Ohio.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.

Steel Stamps and Stencils—
J. H. Ficharty & Co., Cleveland, O.

Stokers—
Playford Stoker Co., Cleveland, O.

Tanks—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.

Tank Cars—
The Wm. B. Pollock Co., Youngstown, O

Tin and Terne Plates—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.

Tin Plate Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Tool Steel—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.

Transmission Machinery—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

Tubes—
National Tube Works, McKeesport, Pa.

Tube Welding—
S. Fix Sons, Cleveland, O.

Tumbling Mills—
The S. Obermayer Co., Cincinnati, O.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland, O.

Twist Drills—
C. H. Besly & Co., Chicago, Ill.

Twist Drill Cases—
Vulcan Mfg. Co., Pittsburg, Pa.

Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Ventilating Fans—
B. F. Sturtevant Co., Boston Mass.

Vises—
Massey Vise Co., Chicago, Ill.

Wire Coating.
The Ironsides Company, Columbus, O.

Wire Filler.
The Ironsides Company, Columbus, O.

Wire Machinery—
The F. B. Shuster Co., New Haven, Conn.
S. W. Goodyear, Waterbury, Conn.
A. H. Nilson Machine Co., Bridgeport, Conn.

Wire Nails—
Cleveland Rolling Mill Co., Cleveland, O.

Wire Rope Coating.
The Ironsides Company, Columbus, O.

Wire Rope Filling.
The Ironsides Company, Columbus, O.

Wood Pulleys—
Dodge Mfg. Co., Mishawaka, Ind.

Wrought Pipe—
National Tube Works, McKeesport, Pa.

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Chicago & Northwestern Ry	25
Chicago Press Clipping Bureau	30
*Chicago Rawhide Mfg. Co	—
Chicago Screw Co	1
Clayton Air Compressor Works	2
Clearfield Fire Brick Co	32
Cleveland City Forge & Iron Co	1
†Cleveland Facing Mill Co	—
Cleveland Rolling Mill Co	28
Cleveland Tool & Supply Co	27
Clinton Iron & Steel Co	28
*C. M. & St. P. Ry	33
Cole, J. Wendell	44
Columbia Fire Clay Co	32
Covert Mfg. Co	30
Cramp & Sons, Wm	40
Cremer & Bicknell	31
Crescent Steel Co	37
Crowell Benedict	1
Delano, E. A	28
Detroit Sprocket Chain Co	22
Dickman & MacKenzie	2
Dixon, Jos., Crucible Co	40
*Dodge Mfg. Co	25
Dover Fire Brick Co	32
Drake, Barton & Co	38
Eclipse Electrotype & Engraving Co	42
Emmerton, P. A	2
Enterprise Boiler Co	1
Erikson, Edward E	23
Fitzsimons & Co	32
*Fix Sons	—
Ficharty, J. H. & Co	2
Forster, Waterbury & Co	1
Fox Machine Co	—
Fraser & Chalmers	31
Frick Coke Co., H. C	1
Gandy Belting Co	44
Garden City Sand Co	32
Gerlach, Peter & Co	29
Gobeille Pattern Co	37
Goodyear, S. W	27
Greenwald Co., I. & E	37
Hall Steam Pump Co	33
Hanna & Co., M. A	28
Harrington & King Perforating Co	1
Harrington Son & Co., Edwin	23
Harrison Safety Boiler Works	21
Hartford Steam Boiler Insp. & Ins. Co	29
Heyl & Patterson	30
†Hickman & Williams	—
Holmes, Strachan & Co	32
Hooven, Owens & Rentschler Co	26
Hunt Robt. W., & Co	2
Illinois Central R. R	24
Ingersoll-Sargent Drill Co	2
Iron Clad Paint Co	40
Ironsides Co	22
Jeffrey Mfg. Co	31
Jenkins Bros	40
Jones & Co., John T	2
Jones Foundry & Machine Co., W. A	1
Jones & Laughlins, Ltd	41
Kentucky Fire Brick Works	23
Konigslow & Bro., E	27
La Belle Steel Co	37
Lake Superior Consolidated Iron Mines	28
Lane & Bodley	39
Laughlin & Co., Alex	31
Lidgerwood Mfg Co	30
Link-Belt Machinery Co	30
Lorain Steel Co	41
Lozier & Co., H. A	43
Lusch, H. B	2
Main Belting Co	38
Marion Steam Shovel Co	44
Massey Vise Co	1
McKeefrey & Co	28
Meehan Boiler & Construction Co	44
Merchant & Co	38
Millers Falls Co	44
Millett Core Oven Co	32
†Modern Machinery	—
Morris & Bailey Steel Co	37
*National Engraving Co	27
National Tube Works Co	43
†Newport Sand Bank Co	—
Nilson, A. H., Machine Co	27
Northampton Emery Wheel Co	38
Nuttall Co. The R. D	26
Oak Hill Fire Brick & Coal Co	23
Obermayer, S. & Co	32
Oglebay, Norton & Co	28
†Ohio Sand Co	—
Ohio Steel Co	28
Otis Steel Co	27
†Parkhurst & Wilkinson Co	—
Perfect Lubricating Metal Co	44
Phœnix Horse Shoe Co	43
Playford Stoker Co	40
Pollock, The Wm. B. Co	2
Prescott Steam Pump Co	39
Q & C Co	21
Rand Drill Co	2
Reading Crane & Hoist Works	30
Riter-Conley Mfg. Co	31
Riverside Foundry Co	22
Robins Conveying Belt Co	31
Rockford Bolt Works	2
*Rockwell & Co., W. S	1—
Ryan, J. J. & Co	37
Salisbury Carbonate Iron Co	28
Sanderson Bros. Steel Co	37
Seaman, Sleeth Co	42
Sennett Co., Geo. B	39
Scioto Star Fire Brick Works	32
‖Sharon Fire Brick Works	1
Shiffler Bridge Co	31
Shuster, The F. B., Co	27
Skinner Chuck Co	27
Spearman Iron Co	44
Standard Paint Co	23
Stevens, F B	44—
Stilwell-Bierce & Smith-Vaile Co	2
Stroud & Co., E. H	2
Sturtevant Co., B. F	1-25
*Superior Charcoal Iron Co	29
Swarts Metal Refining Co	1
Tabor Mfg Co	32
Textor, O	2
Tod, Wm. & Co	30
Totten & Hogg Iron and Steel Foundry Co	42
Union Mining Co	32
Union Boiler Tube Cleaner Co	1
United States Hotel Co	38
Upson Nut Co	1
Van Dorn & Dutton Co	26
Vulcan Mfg. Co	30
Washington Coal and Coke Co	33
Webster, Camp & Lane Machine Co	23
Webster Fire Brick Co	1
We Fu Go Co	31
Wheeling Mold & Foundry Co	44
White, Byron H	37
Wyman & Gordon	43

BRÆBURN STEEL COMPANY, Bræburn, Pa.
MANUFACTURERS OF
FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

DIRECTORS: Wm. Metcalf, Chas. Metcalf, P. B. Hasbrouck, R. P. Kelly, Sec'y. and Treas.

MORE WEAR from your tools
.....Almost no **STEEL EXPENSE**
NO TROUBLE

"It pays to use the most reliable tool steel in the market."

SANDERSON BROS. STEEL CO.
Cleveland Warehouse, 97 Water St.

CRESCENT STEEL
ESTABLISHED 1865 - INCORPORATED 1889.
CRESCENT STEEL CO.
480 PEARL ST. NEW YORK — PITTSBURGH, PA. — 64 & 66 S. CLINTON ST. CHICAGO.

La BELLE STEEL CO., Pittsburgh, Pa.
MANUFACTURERS OF FINE
CRUCIBLE CAST TOOL STEEL.
SPECIAL GRADES FOR ALL PURPOSES.
BYRON H. WHITE,
Western Selling Agent.
OFFICE AND WAREHOUSE: **68 and 70 South Canal St., Chicago.**

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THE MORRIS & BAILEY STEEL CO.
COLD ROLLED STRIP STEEL
FLAT & COILED FOR STAMPING DRAWING BLANKING SPRINGS ETC
WAREHOUSE & OFFICE 68 70 S. CANAL ST. CHICAGO
BYRON H. WHITE
PITTSBURG, PA

BYRON H. WHITE, Western Selling Agent, CHICAGO.

Don't Waste Money in Your Pattern Shop.
THE GOBEILLE PATTERN CO., Cleveland.

The I. & E. Greenwald Co.

Engineers,
Founders and Machinists.

Steam Engines, Shafting, Hangers, Pulleys, Sprocket Wheels, Chains, Etc., Etc.

Headquarters for Mill Gearing of all kind and sizes.
Steam Power Plants complete.

720 East Pearl Street,
CINCINNATI, O.

BRASS FOUNDERS FINISHERS J. J. RYAN & CO.
68-74 West Monroe St., Chicago.
Best Bronze, Babbitt Metals, Brass and Aluminum CASTINGS On Short Notice.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

Special low-phosphorus hard Ore, Bessemer	$3.75
No. 1 Specular, Bessemer	$3.15@3.50
No. 1 Bessemer hematite	2.75@3.25
Hematites No. 1 non-Bessemer	1.90@2.20
No 1. Specular, non-Bessemer	2.00@2.40
Mesabi Bessemer	1.80@2.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$15 15
No. 1 Strong Foundry	$15 65@16 00
No. 2 Strong Foundry	15 15@15 40
Gray Forge, red short	14 65
Gray Forge, neutral	14 40
No. 1 American Scotch	15 75@16 00
No. 2 American Scotch	15 40@15 65
Lake Superior Charcoal	16 50@17 00
PITTSBURG:	
No. 1 Foundry	$15 75@16 00
No. 2 Foundry	15 50@15 75
Gray Forge	14 75@14 50
White and Mottled	13 50
Warm Blast Charcoal	15 00@17 00
Cold Blast Charcoal	22 00@26 00
Bessemer	15 15@15 2
CHICAGO:	
Lake Superior Charcoal	$17 00@18 0
Local Coke Foundry No. 1	15 50@15 75
Local Coke Foundry No. 2	15 00@15 50
Local Coke Foundry No. 3	14 50@14 75
Local Scotch Foundry No. 1	15 50@15 75
Local Scotch Foundry No. 2	15 00@15 50
Local Scotch Foundry No. 3	14 50@14 75
Southern Coke No. 1	16 00@16 25
Southern Coke No. 2	15 25@15 75
Southern Coke No. 3	14 75@15 00
Southern No. 1 Soft	15 50@16 00
Southern No. 2 Soft	15 00@15 50
Southern Silveries	15 50@16 00
Jackson Co. Silveries	17 00@18 00
Ohio Silveries No. 1	@
Ohio Strong Softeners	15 50@16 50
Alabama Car Wheel	17 50@18 00
Malleable Bessemer	15 50@16 00
Coke Bessemer	15 50@16 00
CINCINNATI (reported by Rogers, Brown & Co.	
Southern Coke No. 1, Foundry	$14 75@15 25
Southern Coke No. 2 and No. 1 Soft	14 25@14 75
Hanging Rock Charcoal No. 1, Fdy	17 00@18 00
Tennessee Charcoal No 1	15 00@16 00
Jackson County Silvery No 1	16 00@16 25
Southern Coke, Gray Forge	12 75@13 00
" " Mottled	12 75@13 00
Standard Georgia Car Wheel	15 50@16 00
Lake Superior " "	15 50@16 00
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$14 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	13 75
Ohio Strong Softener No. 1	14 00
Ohio Strong Softener No. 2	13 50
Jackson Co. Silvery No. 1	15 60
Southern Soft No. 1	15 25
Southern Soft No. 2	14 75
Lake Superior Charcoal	14 00@14 50
Coke, Malleable	14 10
ST. LOUIS:	
Southern Coke No 1	$14 75
Southern Coke No. 2	14 25
Southern Coke No. 3	13 75
Southern Coke No. 4	13 55
Southern Gray Forge	13 80
Tennessee Charcoal No. 1	13 75
Jackson County 8 per cent Silicon	16 25
Lake Superior Coke No. 1	15 00@16 00
Southern Car Wheel	15 25@16 25
Genuine Connellsville Coke	4 15
West Virginia Coke	4 10

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons
Old iron rails	$18 00
Old steel rails (6 ft. and over)	14 00
Old steel rails (6 ft. and under)	14 00
Old car wheels	16 00
	Net Tons
No. 1 R. R. wrought scrap	$16 00
Mill scrap	11 50
No. 1 Machine cast scrap	12 50
Iron axles	19 00
Axle turnings	11 00
Wrought turnings (free from cast)	10 00
Cast borings	7 50
Uncut wrought iron boilers	7 00
Steel boiler plates	11 00
Grate bars	8 00
Pipes and flues (clean)	10 00
Tank iron	12 00
Hoop and band iron	9 00
Sheet iron	8 00
Wrought drillings	10 00
Malleable iron	10 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.50c
Angles	1.50c
Tees	1.50c
Universal Plates	1.80@1.90c
Sheared Plates	2.00c

MERCHANT IRON AND STEEL.

[Less than car-lots, Cleveland.]
Rounds and Squares.—Bar Iron.

1 to 1⅞	1.50 Base.
2 to 2⅞	.20 extra.
3 to 3½	.50 "
3⅝ to 4	.80 "
4⅛ to 4⅝	1.00 "
4⅝ to 5	1.30 "
5⅛ to 6	1.80 "
5¼ to 6⅜	"

BABBITT METALS

All standard and special grades.
In sectional molds or bars.

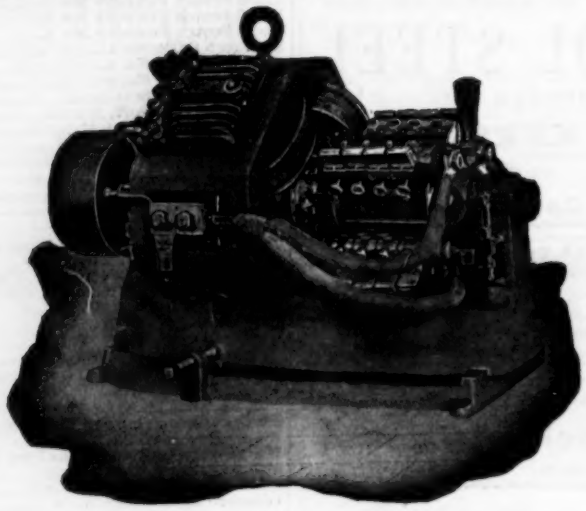
Phila. Chicago. **MERCHANT & CO., Inc.** New York. Brooklyn.

Wrtte us for prices always. It will pay you.

Eddy Dynamo Electro-Plating Machines

— FOR —

BICYCLE PLATING PLANTS.



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EXCLUSIVE WESTERN SELLING AGENTS.

Subscribe for The IRON TRADE REVIEW, $3 per year.

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THE U.S. HOTEL CO.

C.A. SWAN & W.L. BATES MANAGERS

50 ROOMS AT $2.00

50 ROOMS AT 2.50

75 ROOMS AT 3 TO 4.00

All Meals 50¢ Each

LEVIATHAN

Leviathan Belting

Is the strongest, runs the most evenly, and best adapted for Cotton, Woolen, Saw and Planing Mills, Brick and Tile Works and

Heavy Driving Generally.

MAIN BELTING CO.

1219-1235 Carpenter Street. PHILADELPHIA.

120 Pearl Street, BOSTON.

55 & 57 Market St., CHICAGO.

6⅝ to 7¼	2.50 extra
⅜ to ⅞	.10 "
⅜ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13 2	.50 "
5-16 to 1 32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅜ to 1	1.05 Base
4¼ o 6 x ⅜ to 1	.10 extra
6¼ o 8 x ⅜ to 1	.60 "
8¼ o 10 x ⅜ to 1	.80 "
1⅜ o 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1¼	.90 "
2 to 4 x 1⅜ to 2	.50 "
4¼ to 6 x 1⅜ to 2	.60 "
6¼ to 8 x 1⅜ to 2	.80 "
8¼ to 10 x 1⅜ to 2	1.00 "
2 to 4 x 2⅜ to 3	.60 "
4¼ to 6 x 2⅜ to 3	.80 "
6¼ to 8 x 2⅜ to 3	1.00 "
1⅜ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.30 "
¾ to 15-16 x ⅜ to ¾	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
½ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅜ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
½ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1⅜ to 4 x No. 9 to 3-16	.40 "
1⅜ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40
⅜ x No. 9 to 3-16	1.50
⅜ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes o Light Bands.

Oval Iron.

⅜ to 1⅛	.40 extra
⅜ to 13-16	.50 "
⅜ to 11-16	.60 "
⅜ to 9-16	.80 "
⅜ to 7-16	1.10 "
⅜ to 9-16 x 3-16	1.00 "
⅜ to 11-16 x ⅜	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra
⅜ to 2	.50 "
⅜ to 13-16	.70 "
⅜ to 11-16	.90 "
⅜ to 9-16	1.20 "
⅜ to 7-16	3.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes 1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

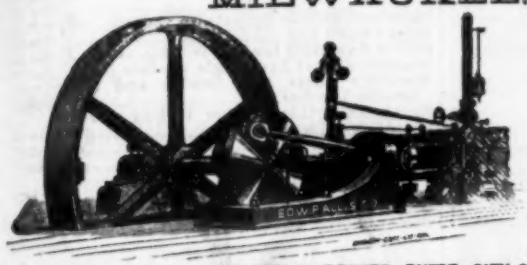
Width In Inches.	English Standard Gauge.		
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16 "	1.50	Base.
		Extras.	
1¼ to 6,	" 10, 11, 12 or ¼"	.05	per 100 lbs.
1 to 1⅜,	" 7, 8, 9 or 3-16"	.10	"
1 to 1¼,	" 10, 11, 12 or ¼"	.15	"
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20	"
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25	"
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10, 11, 12 or ¼"	.35	"
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40	"
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45	"
½,	Nos. 7, 8, 9 or 3-16"	.55	"
½,	" 10, 11, 12 or ¼"	.60	"
7-16	" 7, 8, 9 or 3-16"	.75	"
7-19	" 10, 11, 12 or ¼"	.85	"
⅜,	" 7, 8, 9 or 3-16"	.95	"
⅜,	" 10, 11, 12 or ¼"	1.05	

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.		
7-16 to 3	Nos. 13, 14, 15 and 16	1.60	Base
		Extras.	
7-16 to 2,	" 17, 18, and 19	.05	per 100 lb
7-16 to 2,	" 20	.10	"
7-16 to 2,	" 21	.15	"
7-16 to 1¾,	" 22	.25	"
½ to 1¾,	" 13, 14 and 15	.05	"
½ to 1¾,	" 16, 17 and 18	.10	"

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



MANUFACTURERS OF

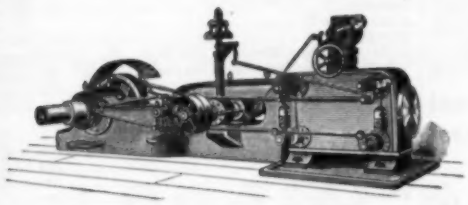
Blowing Engines, Hoisting Engines, Pumping Engines Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills Concentrators, General Mining Milling and Smelting Machinery.

Reynolds Corliss Engines.

NEW YORK. CHICAGO. MINNEAPOLIS. DENVER. BUTTE. CITY OF MEXICO. SAN FRANCISCO. PITTSBURG.

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



Engines,

ALL SIZES.

Simple and Compound.

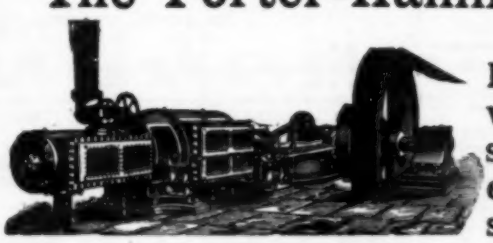
Shafting, Hangers, Pulleys.

Belt Elevators, Saw Mills.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Park Building, Pittsburg.

SEWARD S. BABBITT.

Who builds the best Mine Pump?

PRESCOTT.

Fred. M. Prescott Steam Pump Co.,

MILWAUKEE, WIS.

The Geo. B. Sennett Co., Youngstown, Ohio,

MANUFACTURERS OF

Sennett Compression Coupling

And Other Specialties.

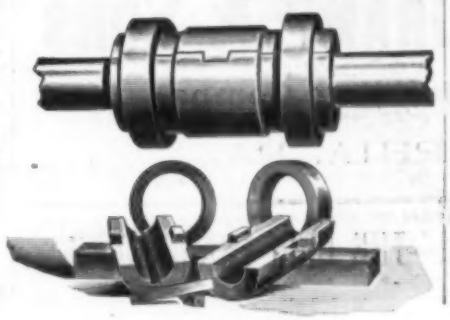
We do not claim novelty in these Couplings so much as good material, good workmanship and extreme simplicity. We make them of a very strong cast iron, with wrought iron bands.

We make also the

SENNETT ENGINE

20 to 40 H. P.

Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.



1¼ to 1⅜,	"	19 and 20	per 100 lbs.
1¼ to 1⅜,	"	21	.20 "
1¼ to 1⅜,	"	22	.30 "
15-16 and 1,	"	13, 14 and 15	"
15-16 and 1,	"	16, 17 and 18	.15 "
15-16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞,	Nos.	13, 14 and 15	.20 "
⅞,	"	16, 17 and 18	.25 "
⅞,	"	19 and 20	.30 "
⅞,	"	21	.35 "
⅞,	"	22	.45 "
¾ and 13-16	Nos.	13, 14 and 15	.30 "
¾ and 13-16	"	16, 17 and 18	.35 "
¾ and 13-16	"	19 and 20	.40 "
¾ and 13-16	"	21	.45 "
¾ and 13-16	"	22	.50 "
¾ and 13-16	"	23	.60 "
11-16,	Nos.	13, 14 and 15	.35 "
11-16,	"	16, 17 and 18	.40 "
11-16,	"	19 and 20	.50 "
11-16,	"	21	.60 "
11-16,	"	22	.70 "
11-16,	"	23	.80 "
⅝,	Nos.	13, 14 and 15	.40 "
⅝,	"	16, 17 and 18	.45 "
⅝,	"	19 and 20	.55 "
⅝,	"	21	.65 "
⅝,	"	22	.75 "
⅝,	"	23	.85 "
9-16,	"	13, 14 and 15	.45 "
9-16,	"	16, 17 and 18	.50 "
9-16,	"	19 and 20	.60 "
9-16,	"	21	.70 "
9-16,	"	22	.80 "
9-16,	"	23	.90 "
½,	"	13, 14 and 15	.55 "
½,	"	16, 17 and 18	.60 "
½,	"	19 and 20	.70 "
½,	"	21	.80 "
½,	"	22	.90 "
½,	"	23	1.00 "
7-16,	"	13, 14 and 15	.80 "
7-16,	"	16, 17 and 18	.90 "
7-16,	"	19 and 20	1.00 "
7/16,	"	13, 14 and 15	1.00 "
7/16,	"	16, 17 and 18	1.10 "
7/16,	"	19 and 20	1.20 "

Sheet Iron.

No. 10	1 50
No. 12	1 70
No. 14	1 60
No. 15-17	1 75
No. 18	1 85
No. 20	2 00
No. 22-24	2
No. 25-26	2 20
No. 27	2 30

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 35
Shell	1 45
Flange	1 55
Marine Flange	1 60
Fire Box	2 05

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1c. "
100 to 104 in. wide	1½c. "
104 to 108 in. wide	special.

Flats.	cts. lbs.
2 to 9-16 in. wide by 2 to ½ thick	.08

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 40
Open-hearth Tire	"	1 45
Open-hearth Spring	"	1 80
Sleigh Shoe	"	1 45
Toe Calk	"	1 90
Cutter Shoes, tapered and bent	"	1 60

American Cast Tool Steel.

ROUND, SQUARE, AND OCTAGON.	cts. lbs.
1 to 2 in. inclusive	.08
9-16 to ½ in. "	.08
7-16 to ⅜ and 2½ to 3 in	.09
3½ to 4 in	.09½
⅝ to 11-16 and 4½	.10
⅝ to 6 in	.10½
¼ to 9-32 and 6¼ to 7 in	.11
1 in	.13

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	2 55

Wrought Pipe and Boiler Tubes.

Lap weld black, base, and 10 per cent				78
Butt " "	"		"	72
Lap " galv.	"		"	70
Butt " "	"		"	67
Boiler tubes 2¼" and smaller				72½
Boiler tubes 2½" and larger				72
Casing screw and socket joint				dis. 50
Casing inserted joint				dis. 45

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Anvils.

American	9 to 9011
Wright's	9 to 12

Bellows.

Blacksmiths'	Hill's	dis
	Bullock's	dis 50 & 1
Moulders'		dis 40 & 10 & 10
Hand		dis 40 & 10 & 50

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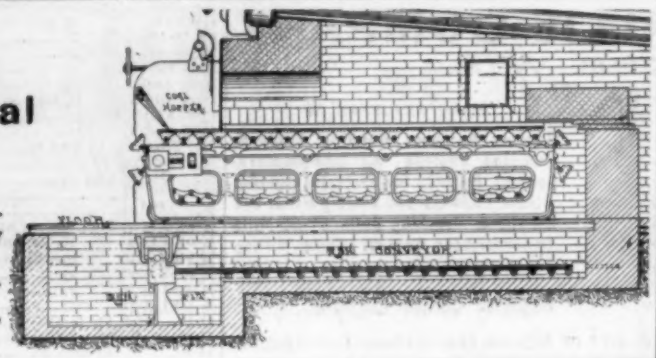

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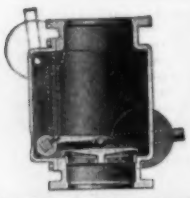

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Shults Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
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Boston Blower Co.,	dis 35

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Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 80
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 45
" Little Giant Drill	dis 33⅓
Horton's Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 45
Sweetland "	dis 40
Almond Drill	dis 40
Morse "	dis 20
Skinner's Combination Lathe	dis 40&15
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 30

Cutters and Reamers.

Cleveland	dis 10@11
Pratt & Whitney	dis 10@11
Standard	dis 10@11
Morse	dis 10 to 1
Brown & Sharpe, Milling Cutters	dis 1
" " Gear Cutters	dis 1

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Drill Sockets	dis 25
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Cleveland " "	dis 60@60&5

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	No. 4 to No. 54 46 gr.	150 gr.	Flour, C. F F. F
Kegs, ₩ lb	4½c	5 c	2¾c
½ kegs ₩ lb	4¾c	5¼c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	c
10 lb cans less than 10	10 c	10 c	½c

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Celluloid	dis 10&33⅓
Northampton	dis 50
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

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Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F.	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70
Western	dis 70
Stub's	dis 2
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 55
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	10c
" " " " over 5 lbs	8c

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Illinois Bolt Co. list	dis 75

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Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	15⅝	11⅛	8⅝	6	5⅜	5⅛	
Washers	9	8	7	5	4⅛	4⅛	4⅛

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" 6 to 7 lbs	dis $ 13 60

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Valley Jctn. & Way Stations..	*6:25 P M	*7:25 A M
Marietta, Wheeling & Chicago	†9:25 P M	†7:25 A M
Cleveland Press Special.....	†9:25 P M	†2:00 P M
Akron, Canton & Wheeling...	*10:20 A M	*3:30 P M
Akron, Canton & Chicago.....	*8:05 A M	*6:35 P M
Akron, Canton & Marietta,...	†2:10 P M	†11:00 A M
Pittsburg, Washington, D. C., & Baltimore.....	† 2:10 P M	†11:00 A M

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Elyria Depot: Huron St., West Side.

South Bound.			Central Standard. Lorain Branch	North Bound.		
15	13	11		12	14	16
P.M.	P.M.	A.M.	LV. AR.	A.M.	A.M.	P.M.
4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:40	2:30	6:44	Elyria.....	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6.58
5:15	3:12	7:23	Lester.....	8:25	10:50	6:40
5	3	1	Main Line	2	4	6
5:30	2:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:26	8:22	Lester.....	7:29	10:49	6:19
6:52	3:35	8:30	Medina	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling.....	6:48	10:12	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover.	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport ...	.....	6:05	1:40
.....	8:25	.....	Bellaire.....	.....	5:50	.....
P.M.	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

No. 9 leaves Lorain 9:50 a.m., Elyria 10:05, Grafton 10:21; arrives Lester Junction 10:40. No. 10 leaves Lester Junction 3:25 p.m., Grafton 3:42, Elyria 3:57; arrive Lorain at 4:10 p.m.

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Bessemer Steel Works,
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Cut-Nail Works,
Tin Plate Works,
Stamping Works,
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Wire Rod and Wire Mills,
Wire Nail Works,
Iron and Steel Bridge Builders,
Iron and Steel Ship Builders,
Horse-Nail Works,
Locomotive Works,
Malleable Iron Works,
Cast Iron Pipe Works,
Cast Iron Soil and Plumbers' Pipe Works,
Wrought Iron, Wrought Steel and Riveted Pipe Works,
Seamless Tube Works,
Chain Works,
Bolt, Nut and Rivet Works,
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Car Builders in the United States

ALSO A LIST OF THE

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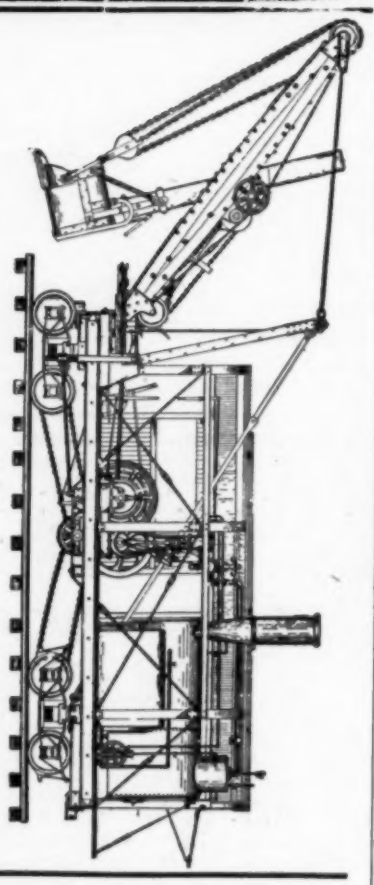

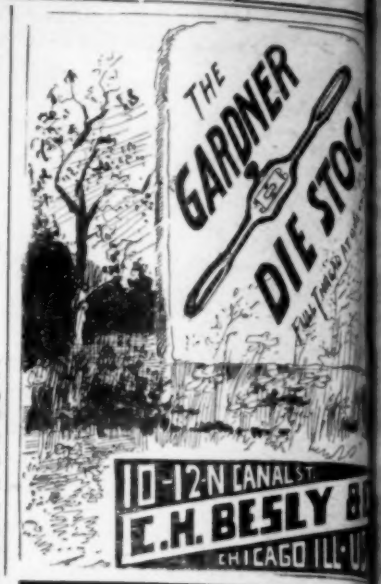

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